

MEANINGFUL USE OF SIMULATION AS AN EDUCATIONAL METHOD  
IN NURSING PROGRAMS

BY

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## Abstract

The purpose of this descriptive study was to examine the use of simulation technology within nursing programs leading to licensure as registered nurses. In preparation for this study the Use of Simulation Technology Inventory (USTI) was developed and based in the structure, processes, outcomes model and the current literature on simulation. The survey was then piloted in one Midwestern state. Total item content validity index reported from the first use was 0.97. The USTI was sent to nursing programs in three Midwestern states, and 23 programs of nursing completed the survey. Data were both quantitative and qualitative in nature.

Findings indicated that the majority of the respondents reported that they were or would be using simulation to teach undergraduate students. The courses that simulation technology were most frequently used in were medical-surgical nursing and obstetrics. Respondents described their physical simulation space, how they use simulation within their program, and student evaluation practices.

Implications include research implications, educational implications and best practice implications. The most important research implications included the need to develop, pilot, and use methods to assess simulation outcomes for students and against program outcomes. Nursing education has found the gap between academia and practice is increasing. The shortage of nursing faculty, clinical sites in not only medical surgical nursing, but in many specialty areas, and decreasing financial support for nursing education have pushed nursing programs to explore new teaching methodologies. Simulation technology is one of the newer methodologies that has had a positive impact within nursing education.

The best practice implication from this study was that nursing programs should develop a plan for the funding, implementation, and use of simulation technology. The plan should include a curricular map so that the simulator is included in all key nursing courses. Finally, this study is unique in that only one other study exists that examines what is occurring with simulation use. More research needs to be completed looking at other regions of the US so that best practices can be established.

Key words: simulation technology, best practices, simulated learning environments, nursing education,

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## **Chapter 1: General Introduction**

### **Introduction**

A crisis exists within the nursing profession. Not only is there a shortage of qualified nurses to give care but they are inadequately prepared for the patients they encounter in our current health care environment (American Association of Colleges of Nursing [AACN], 2007, Institute of Medicine [IOM], 2003). The shortage of registered nurses (RNs) is expected to peak in 2020, with an estimated lack of 340,000 nurses to give care in acute and long-term facilities (AACN, 2007).

Among other things the shortage has contributed to problems in the delivery of safe care to patients, and even more directly to the quality of a nurse's practice. A recent survey of RN's in practice showed "80% observed the shortage had frequently or often negatively affected the timeliness of care; over 70% perceived the shortage had frequently or often negatively influenced patient centeredness, effectiveness, and efficiency of care; and almost two-thirds of RNs reported the shortage had negatively affected the safety and equity of care" (Buerhaus, Donelan, Ulrich, Norman, & Dittus, 2006, p. 8). Consumers of health care agree as well, with 40% reporting that health care quality was declining and attributed this to "workload, stress or fatigue among health professionals (74%); too little time spent with patients (70%); and too few nurses (69%)" (Kaiser Family Foundation [KFF], Agency for Healthcare Research and Quality [ARHQ], & the Harvard School of Public Health, 2004, para.24).

The shortage of new nurses can be directly linked to problems within nursing education that include: shortage of qualified nursing faculty, lack of educational space, lack of clinical sites and clinical preceptors (AACN, 2007). In 2005, the main reason nursing programs leading to

registered nurse degrees reported they refused entry to 32, 797 new students was the lack of faculty to teach students (AACN, 2005). Regardless of the problems within nursing education, nursing faculty have the responsibility of educating nursing students with basic care giving skills necessary to survive in today's complex health care environment, as well as the necessary cognitive, perceptive and affective skills to transfer knowledge and skills into any new situation they may encounter (Fraser & Greenhalgh, 2001; IOM, 2003). Health care institutions want highly trained, capable care givers, who have the ability to function in these complex environments (Health Resources and Services Administration, 1999).

In 2003, the Institute of Medicine (IOM) published a report on health professions education and found that health care professions are poorly equipped to handle what they will experience in the practice setting (IOM, 2003). The IOM report stated that the new health care professional should be competently “educated to deliver patient-centered care as members of an interdisciplinary team, emphasizing evidence-based practice, quality improvement approaches, and informatics” (IOM, 2003, p. 3). The most highly rated skills that new graduate nurses can possess are critical thinking and reasoning, highly developed communication skills, the ability to assess, intervene and evaluate their actions within health care situations, as well as a large variety of technical skills (American Nurses Association [ANA], 2004; AACN, 2008). What the IOM report found was that “health care professionals are not adequately prepared – in either academic or continuing education venues – to address shifts in the nation's population” (IOM, 2003, p. 2).

The inadequacy of health care professionals has a direct impact on the quality of health care that health care recipients receive, and the rates of error that exist within the health care system. Error has been consistently attributed to not only the shortage of health care workers, but to a lack of knowledge and skill with diagnosis, treatment, use of equipment, and the use of

medications (IOM, 2000). A recent publication by the IOM (2007) reported that medication error was multi-factorial, and attributable to knowledge, technical skill, the health care system within which we practice and other human factors. The IOM has encouraged not only changes in the health care system, but major changes in the way that health care workers are educated (IOM, 2003). These changes include increasing the use of technology in education as well as specific training on how to use information systems to keep current and gain just in time knowledge when caring for patients (IOM, 2003).

The use of technology has been suggested as a way to ease the issues facing faculty in nursing education (AACN, 2005; Simpson, 2003). Simulation technologies, in multiple forms, have been used to help students make the cognitive leaps between knowledge and application, shown to extend nursing faculty, and solve our shortages in clinical sites (Nehring, 2008).

### **Background and significance of the problem**

Simulation technology (high- and low-fidelity human simulators) is currently being used in multiple ways to supplement the education of health care providers. However the use of simulations in health care education is not new. Nurses have been simulating the health care environment for decades (Jones, Hunt, Carlson, & Seamon, 1997; Peteani, 2004). Through the use of standardized patients, case studies, and problem based learning nursing students have learned how to care for patients in a variety of situations. The use of simulation technology is revolutionizing nursing education due to the sheer number of schools that have adopted and embraced this technology (Hovancsek, 2007; Nehring, Ellis, & Lashley, 2001).

Current nursing education literature is reporting very positive results from the use of simulation as an educational method (Johnson, Zerwic, & Theis, 1999; Nehring, 2010b). The use

of simulation has given faculty a unique way to solve many of the problems in nursing education (Nehring, 2008; Nehring, Ellis, & Lashley, 2001). High-fidelity simulations have been reported to give students the perception of “real life” situations. Current literature describes a few of the ways that nursing faculty are using simulation technology. Simulations can be used to reinforce didactic material, to expose students to clinical experiences they may only have the opportunity to read about, or in place of or enhancement of the clinical experience when there are limited clinical placements. Additionally, simulations can allow the faculty the opportunity to solve clinical instructor/ preceptor issues, as multiple students can get experiences in a very short period of time (Hovancsek, 2007; Nehering & Lashley, 2004).

Current literature also describes the methods for obtaining, implementing and using simulators as an educational method, based on the experiences of individual institutions of higher education (Jeffries, 2006). However, with limited nursing faculty, decreasing educational budgets, and shortages of nurses it is important to determine the best practices for the implementation and use of simulation technology within nursing programs. The reality of larger institutions may be hard or unrealistic to obtain for smaller more isolated nursing programs, or those nursing programs who were not in the initial adoption of this technology (Curtin & Dupuis, 2008).

Research evaluating the initiation, impact and actual use of simulation on a larger scale has not been reported in the current literature. This lack of information makes it difficult for academic nursing programs to not only initiate but sustain the use of simulation within their programs. The agencies that evaluate and accredit nursing programs such as the American Association of Colleges of Nursing(AACN), the National League of Nursing (NLN), different state nursing associations, State Boards of Nursing (SBN), and the National Council of State



Boards of Nursing(NCSBN) have explored ways in which to help nursing programs make decisions regarding simulation implementation.

The Kansas State Board of Regents (KBR) developed 10-year plan to give over \$30 million in development grants to Kansas Nursing Programs to increase the use of education equipment and technology, increase the number of nursing faculty, and give the schools monies to offer nursing scholarships to increase the number of nurse educators in the state of Kansas (D. Richardson, personal communication, 2007). In 2006, Kansas Nursing Programs were invited to apply for the KBR technology grants. Fourteen of the 44 nursing programs that lead to registered nursing (RN) degrees in the State of Kansas received \$3.4 million in grants through the Kansas Board of Regents to obtain new human-patient simulators or to update existing simulation labs. These grants were the first-year of the 10-year initiative by the Kansas Board of Regents. It was hoped that these grants would ease the shortage of faculty within Kansas Nursing Programs and increase access to clinical experiences in rural areas that have significant clinical site shortages. The 14 nursing programs have been challenged with the adoption and implementation of the human-patient simulator as a new educational technology, concurrently, while having the same educational challenges they had prior to receiving the new technology. Other states are facing similar situations in which nursing programs are exploring ways to offset the shortage of nurses, and find ways to deal with their educational issues (D. Richardson, personal communication, 2007).

## **Purpose**

Simulation technology is being rapidly assimilated in nursing programs; many schools are even developing centers of simulation. The purpose of this study is to twofold: to describe

the processes and structures used by nursing programs when adopting simulation technology, and to begin to determine the outcomes that are being obtained as well as the outcomes nursing programs are hoping to achieve from simulation technology use. The Use of Simulation Technology Inventory (USTI) was developed to allow the stakeholders in nursing education to begin to understand how simulations are being used so that best practices can begin to emerge.

### **Research questions**

The following research questions will direct this exploratory descriptive investigation. During the process of obtaining, adopting and implementing simulation technology:

- 1) What are the experiences and processes of the programs offering nursing degrees during the initiation, implementation and utilization of simulation technology?
- 2) How have the nursing programs, who have adopted simulation technology, implemented and used simulation technology across their curriculum?
- 3) What have the nursing programs experienced since the adoption, implementation and use of simulation?
- 4) What methods are nursing programs using to evaluate (both formative and summative) the use of simulation technology?
- 5) What are the outcomes nursing programs have experienced since the implementation of simulation technology?

## Central Concepts

The framework for this research study was derived from Donabedian's structure, process and outcomes framework. Structures are thought to be the stable characteristics of an academic institution. The structure is the human, physical and financial resources that comprise the academic institution. The structures of the academic institution are objective and measurable. The structure includes the numbers of employed professionals, their training, qualifications, and where they are located. Structure also relays the physical size of the institution: the number of buildings, the equipment they possess, geographic location, and proximity to other collaborating institutions. The structure includes the financial resources that an academic institution has available for educational programs, technological equipment, physical environments, and further training employed professionals not only as educational specialist, but also as technological specialist (Donabedian, 1980, Upenieks & Ablew, 2006).

Processes are described as the mechanisms that guide the development of a educational programs within a school of nursing so that their organizational goals can be met. Processes are ongoing and constantly being redefined based on the organizational needs. The processes related simulation technology use are the general and specific factors that support it's adoption, implementation and use at a school of nursing. These include items such as faculty involvement, training and their use of simulation technology (Donabedian, 1980, Upenieks & Ablew, 2006). The processes ultimately lead to the outcomes obtained from the simulation technology use.

The desired outcomes from simulation use have been to "replicate some or nearly all of the essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for real in clinical practice" (Morton, 1997, p. 66). Simulation

technology gives nursing faculty the ability to provide the students with clinical experiences that may not occur frequently, or that have a high risk of poor outcomes. Students can also practice basic skills, demonstrating competency while caring for patients. Other benefits that are just being explored are the ability to give students opportunities to interact in multidisciplinary situations, or to practice emotionally complex care situations, improving their communication within the health care environment (Gabirol, 2007). The structure and process determines the outcomes that can be measured. Ultimately, the outcomes that Nursing Programs are hoping to obtain from simulation are highly competent, capable nurses who provide high quality, safe care to multiple clients in a variety of situations. Nurses who can function and communicate within the health care team, and who possess a wide variety of technical and non-technical skills (AACN, 2008; IOM, 2003).

### **Definition of Terms**

The following definitions were derived from a synthesis of the simulation and innovation literature. These terms are used to describe the specific components of simulation implementation in nursing programs.

1. Simulation: Simulations in nursing education are created learning experiences based on clinical scenarios in which an individual or group of individuals must care for a client holistically, meeting all medical and non-medical needs (Dearman, 2003; Fink, 2003; Hovancsek, 2007; Johnson, et. al, 1999). Simulations have been defined as “activities that mimic the reality of a clinical environment and are designed to demonstrate procedures, decision-making and critical thinking techniques such as role playing and the use of devices such as interactive video or mannequins” (Jefferies, 2005, p. 97). Simulations can be further

differentiated along a “continuum - from low-fidelity and high-fidelity” (Hovancsek, p. 3; Jeffries, 2006). The higher the fidelity of the simulation the more it mimics a real situation. Simulations can take several forms: photographs, video and audiotapes, case studies, and human patient simulators (Jefferies, Dearman).

2. Human-patient Simulator (HPS): a computerized mannequin, that represents part or the whole human body, having the ability to mimicking normal physiological and pharmacological responses (Cooper & Taqueti, 2004; Feingold, Calauce, & Kallen, 2004; Nehring, et. al, 2001). The human-patient simulator includes all the necessary support technology (computer hardware and software; and other necessary things to support the simulator) (Nehring, et al).

3. Implementation and use of simulation technology: when nursing faculty or others with simulation technology, use high-fidelity human patient simulators.

4. Nursing Programs: for the purpose of this study nursing programs will refer to those programs that lead to degrees that allow graduates to sit for the National Council Licensing Exam – for Registered Nurses (NCLEX- RN). This would include both associate and bachelor degree programs.

## **Assumptions**

The following assumptions guided this study.

1. Nursing Program’s goal is to give students quality education.
2. Quality nursing education is understood through it’s structures, processes and the educational outcomes.

3. Nursing students are adult learners who learn through problem-based experiential learning.
4. Shortages of nursing faculty, clinical sites, and complexity of the current health care system have necessitated new methodologies in nursing education.
5. Use of simulation as an educational method facilitates higher quality educational outcomes.

## **Conclusion**

While there are many reasons to obtain a human-patient simulator, and advanced preparation can be made prior to the simulators arrival, what happens after the human-patient simulator arrives, how Nursing Programs and individual faculty adopt and use simulation technology is of interest to others. While some literature exists that discusses the structure of the simulation programs little exists that describes the processes and experiences surrounding the use of simulation by nursing programs. This research will allow the processes and experiences to inform future processes of adoption, implementation and use of innovative simulation technology.

## Chapter II: Review of the literature

### Introduction to the Problem

Graduate nurses and nurse executives agree that the distance between what is learned in school and the reality of practice has increased dramatically over the past several years. New graduates are simply not ready for the practice reality of the health care system in which they practice (Gerrish, 2000; Goode & Williams, 2004; Halfner & Graf, 2006; Halfner, Graf, & Sullivan, 2008; Lofmark, A., Smide, B., & Wikblad, K., 2006; Nehring et. Al., 2001;). Goode and Williams contended that new graduates lacked the ability “to recognize abnormal physical and diagnostic findings, supervision of others who provide care, performing psychomotor skills, and responding to emergencies” (p. 71). Lowry, Timms, and Underwood (2002) reported graduates lacked the ability to manage their time effectively, organize and prioritize their care. New graduates also found it difficult to perform basic psychomotor skills, as well as basic leadership and teamwork skill.

In 2003, the Institute of Medicine (IOM) released *Health Professions Education: A Bridge to Quality* which described changes that needed to occur in order to increase the quality and safety within the health care system. The IOM reported that “clinical education has not kept pace with or been responsive enough to shifting patient demographics and desires, changing health system expectations, evolving practice requirements and staffing arrangements, new information, a focus on improving quality or new technologies” (p.1). The increasing complexity of the health care system has providers consistently working beyond their knowledge and capacity (Plsek & Greenhalgh, 2001).

Nursing education has struggled to keep educational standards equivalent with the changes in health care due to shortages of nursing faculty, educational space, clinical sites, and preceptors, as well as decreasing educational funds (AACN, 2007). Regardless of these factors nursing faculty must educate future nurses with the psychomotor, cognitive, and perceptive skills to give high quality care to their patients (Fraser & Greenhalgh, 2001; IOM, 2003). Nursing programs continually strive to maintain quality of education. Quality in nursing education is ensured through the regulatory body of the fifty State Boards of Nursing and various accrediting bodies such as National League for Nursing Accrediting Commission (NLNAC), and Commission on Collegiate Nursing Education (CCNE). This regulation includes consistency between the structure, processes, and outcomes in nursing programs (Smith & Crawford, 2004).

The structures and processes of nursing schools ensures not only stable state board (NCLEX) pass rates, but successful practice by nurse graduates in the complex health care environment (Smith & Crawford, 2004). In order for graduate nurses to practice successfully in current clinical environments, nurse educators must help nursing students make connections between didactic knowledge and psychomotor skills, while learning the necessary critical thinking skills that will carry them forward into the future (AACN, 2007; IOM, 2003).

There are multiple educational methodologies that can be used to help nursing students draw the connections between cognitive knowledge, thinking skills, and psychomotor skills. Interactive learning methodologies have been found to be highly successful in making these connections. The most recent experiential learning method used in nursing education is high-fidelity human patient simulation. Currently, key nursing leaders and organizations have decided that nursing education should include the use of simulation (Nehring, 2008). Several key nursing organizations have held forums to determine meaningful use of simulation to educate future



nurses. How simulation is currently being implemented and used within nursing programs is not fully understood. The use of simulation is based on the structure and processes of the nursing programs. Some but not all schools evaluate educational methodologies based on achievement of educational outcomes.

This literature review will begin by briefly describing the learning theories that are currently supporting nursing education to understand the similarities between nursing theories and learning theories used to support simulation use. Simulation background and definitions will be discussed. Simulation use in healthcare and nursing education literature will include the historical perspective of the use of simulations, current literature and research on the use of simulation, outcomes of simulation use, the advantages and disadvantages of simulation use, the importance of simulation in nursing education, and nursing educational standards about simulation use. Lastly, a model to examine simulation use in nursing programs will be discussed.

### **Learning Theories that support Nursing Education**

An assumption in academic nursing is that the students are adult learners. The underlying adult learning philosophy is based on several broad assumptions. The adult learner is internally motivated to learn and is actively involved in their learning process (Knowles, Holton, & Swanson, 2005). They possess life experiences that add depth to their knowledge. They display an eagerness to learn, and the ability to be self-directed in their learning. Adult learner's philosophical orientation to learning focuses on problem-centered learning (Knowles, Holton, & Swanson). Merritt (1983) examined learning style preferences of nursing students and found that they preferred active learning environments that "included direct contact with the content or situation being studied" (p. 371) or problem-centered learning.

Problem-centered learning is essential in health care education because it provides the learner with active, complex and dynamic learning experiences. Problem-centered learning is initiated within a learning experience that forms an interaction with what has previously been learned. New information and ideas as well as an internal and external reflective dialog are incorporated into the experience (Fink, 2003). These created learning experiences mimic “real life” and allow the learner to “practice” within situations they will experience in the future (Kolb, 1984). Most experiential learning processes have similar stages: an experience, some kind of critical thinking or reflection upon the activity, an internal cognitive abstraction that helps the learner place the experience within their cognitive frames, and finally the ability to actively apply the information to novel learning situations (Gibbs, 1988; Kolb). Two important cognitive practices emerged from the practice of problem-centered learning: reflective practice and the application of learned situation to future novel situations (Fink, 2003).

Reflective practice occurs before, during and after the created learning experience or simulation. Reflective practice occurs as the student prepares for the learning experience, during the experience as the student participates, and after the experience in the form of written and oral debriefing and feedback from other participants and faculty. Reflection allows the student to make meaning from the experience by transforming the experience into new cognitive schema, adapting and changing the meaning of the information to fit future novel situations (Fink, 2003; Fraser & Greenhalgh, 2001).

The application of the meaning of the learning experience to novel situations is what allows the student to learn how to function in the complex health care situations. It allows the educator to help the student not only gain the necessary competencies that the environment demands, but it makes the student a capable practitioner in the future. Frasier and Greenhalgh

(2001) defined capability as the “extent to which individuals can adapt to change, generate new knowledge, and continue to improve their performance” (p. 799). To become capable is to become more than competent. It allows the student to achieve the highest level of learning outcomes; it helps the student gain the future.

### **Simulation Background and Definitions**

Simulations in nursing education are created learning experiences based on clinical scenarios in which an individual or group of individuals must care for a client holistically, meeting all medical and non-medical needs (Dearman, 2003; Fink, 2003; Johnson, Zerwic, & Theis, 1999). Simulations have been defined as “activities that mimic the reality of a clinical environment and are designed to demonstrate procedures, decision-making, and critical thinking techniques such as role playing and the use of devices such as interactive video or mannequins” (Jefferies, 2005, p. 97). Simulations or the use of clinical scenarios is not new to nursing, and can take several forms: photographs, video and audiotapes, case studies, and human patient simulators (Dearman; Jefferies, 2005). The specific type of simulation used is dependent on the purpose of the desired learning experience (Dearman). Peters, Vissers, and van der Merr (1998) have suggested that there are four global purposes to any created learning experience: training and education; assessment and diagnosis; exploration or development of new knowledge; and research. The academic purposes of simulation experiences are the reinforcement of previously taught didactic content, to teach new information, to allow students to practice clinically in a safe, non-threatening environment, to assess and evaluate a student’s knowledge or performance clinically, and to create a stimulated learning environment (SLE) (Feingold, Calauce, & Kallen, 2004; Jeffries, 2006)

## **Theoretical Frameworks Used to Develop Nursing Simulations**

Theoretical frameworks used to develop nursing simulations differ based on the underlying nursing curriculum. Curriculum is developed to meet the educational outcomes of the respective nursing programs. When simulation is incorporated throughout the curriculum a variety of theoretical frameworks can help “explain how simulation is being used to meet the educational goals of the program” (Nehring, 2010b, p. 28). The more simulations are adopted and integrated throughout nursing curriculum the more necessary theoretical frameworks become to evaluate the meaningful use and value added to nursing curriculum.

A variety of theoretical frameworks have been developed for use with simulation. Benner’s model of skill acquisition for nurses has been used repeatedly with simulations within educational curriculum (Ferguson, Beeman, Eichorn, Jaramillo, & Wright, 2004; Larew, Lessans, Spunt, Foster, & Covington, 2006; Long, 2005;). Other theories that have been used successfully with simulation are Kolb’s theory of experiential learning (Kolb, 1984); Shon’s theory of reflective thinking (Shon, 1991); Tanner’s theory of clinical judgment (Tanner, 2006); and Pesut and Herman’s theory of clinical reasoning (Pesut & Herman, 1999). All of these theories and models have several key concepts in common: social constructivism, reflection, and mastery of a situated experiential learning experience. These theories and their key concepts mirror the theoretical frameworks used currently in nursing, making simulation an excellent teaching method in nursing education (Nehring, 2010b).

Jefferies (2005, 2006, 2007) has developed a framework and model that can be used to guide the educator in the design, implementation and evaluation of simulations. The model is based on Chickering and Gamson’s (1987) best practices in education. This simulation model is

being used nationwide as the standard for simulation practices in nursing (Childress, 2005). Multi-site exploratory testing of the Educational Practices Instrument, Student Satisfaction and Self-Confidence Instrument, and the Simulation Design Instrument has provided validity to this framework, which can be used for the design and evaluation of the simulation process. The model focused on the use of simulation as an educational intervention, which helps to shape the best educational practices. Jeffries model has five key concepts: teacher, student, educational practices, outcomes, and simulation design characteristics (Jeffries, 2005, 2006, 2007). The teacher, student and educational practices have a strong overlapping interaction, where outcomes are a result of their interaction between those three and simulation design characteristics.

Each of the key concepts have sub-concepts that are the basis for much of the research regarding simulation use in nursing education (Jeffries 2005, 2006, 2007). The sub-concept of interest for the teacher is demographics of the instructor such as age, years teaching, courses taught, and teaching philosophy. The most important sub-concepts for the student are what type of program they are in, the level they are in at within the program and their age. For educational practices active learning, feedback, student/faculty interaction, collaboration, high expectations, diverse learning, and time on task are the most important key sub-concepts. Outcomes examine learning (knowledge), skill performance, learner satisfaction, critical thinking, and self-confidence as the most important key concepts. The simulation design characteristics include: determining the purpose and objectives of the simulation and then determining what information to share with the students, providing learner support for the participants, problem solving of students throughout the simulation process (flexibility of students and faculty with an active learning environment), feedback or guided reflection (called debriefing in initial model), and

fidelity of the situation(simulations should mimic real life as closely as possible) (Jeffries 2005, 2006, 2007).

Debriefing is a reflective activity that is designed to meet defined goals. There are many different models of debriefing (Thompson, 2008). Debriefing experts do not all agree on how to facilitate debriefings, but they agree on the goals of debriefing and certain components of debriefing. The goals of debriefing are: acknowledging and let go of emotions, strengthening simulation objectives through reinforcement, simplifying the results of the simulation by illuminating the meaning of what occurred, augmenting critical thinking and developing increased problem solving, promoting reflective learning, and finally connecting the simulation to real life events (Fanning & Gaba, 2007).

These dimensions cover the spectrum of the simulation as an educational strategy across all levels of education. Regardless of the model or framework chosen to guide the simulation, the emphasis is on clear educational objectives, a good design, and measurable outcomes with a strong evaluation plan.

## **Simulation Use in Health Care and Nursing Education**

**Historical Perspective of the Use of Simulations.** While simulation technology (high and low fidelity human simulators) is relatively new to health care in general and more specifically nursing, the use of simulations across multiple high risk settings is not. Technology based simulations with debriefing experiences have been used in the military, aviation, and crisis situations for the last several decades (Kern, 2001; Prince, Oser, Salas, & Woodruff, 1993). The impressive reduction in aviation disasters has lead to a reexamination of the use of simulation in health care as a method to improve healthcare outcomes (Grantcharov et.al, 2004).

Simulations without the use of technology have been used in health care education since before the invention of low- or high-fidelity human patient simulators. One of the first simulators, Mrs. Chase, developed in the 1950's was used to help nursing students practice and perfect their nursing skills on a human like mannequin. Mrs. Chase was not computerized nor did she have many moving parts, but the use of simulations in nursing education added the value of a safe practice environment (Herman, 1981; Peteani, 2004). Computer- run simulators were developed at the University of Southern California in the mid-1960's and called Sim One (Denison & Abrahamson, 1969). It was used to train anesthesiologists in patient intubation. High-fidelity simulation was short lived and did not catch on as an instructional method. During the late 1960's into the 1970's a simulator named Harvey was developed at Georgetown University (Gordon , et al, 1980; Peteani). In a 1987 pilot study, Harvey was used for training 208 senior medical students during their cardiology elective. Those who trained on Harvey outperformed those who had only patient interaction. The evaluation of skill was based on post-test simulations with Harvey and live patients (Ewy, et al., 1987). In between Harvey and our current high-fidelity simulators several more anesthesia task trainers were developed, each with increasing fidelity (Cooper & Taqueti, 2004). In research studies examining the use of the early simulators it has been found that students are enthusiastic of their use and that they are able to demonstrate high levels of fidelity to real life situations. There are few studies that demonstrate the value of simulation in the student's ability to transfer the information to real life performance (Cooper & Taqueti, 2004). These early simulators have provided renewed interest in the use of simulation as a teaching modality. Currently there are multiple types of task trainers for multiple medical specialties, high-fidelity simulators that are completely wireless with full simulator

capabilities from the blinking of eyes, to abnormal heart and lung capabilities, to the ability to react to administered medications.

Since the beginning of formalized nursing education simulated learning experiences have been used as a teaching method. These simulated learning experiences have made use of the increasing technology. The evolution of different simulations has ranged from role-playing; games, standardized patients, to computerized instruction, standardized patients, partial and complex task trainers, integrated simulators (low- and high-fidelity simulators), to virtual reality (such as second life) and haptic systems (Nehring, 2010a). Simulation technology (high and low fidelity human simulators) is being used more and more frequently as an educational method to enhance learning in health care and nursing education.

**Current literature and research on use of simulation in nursing.** Simulation technology is becoming common place in health care education. Simulations are used in the different areas of health care as well as across all levels of education. Simulation within nursing programs has increased drastically over the past decade (Hovancsek, 2007; Nehring, Ellis, & Lashley, 2001). Simulation use literature has increased dramatically as well over the past several years. Several simulation societies, user groups, and/or associations have been formed and hold regular meetings, host list-serves, and publish magazines that disseminate simulation literature. This has led to international dissemination of simulation knowledge and the adoption of simulation internationally (Hovancesek, et.al., 2009). The majority of the literature to date has been regarding isolated uses and the outcomes that were evaluated (Hennenman, & Cunningham, 2005; Henneman, Cunningham, Roche, & Curnin, 2007; Jarzemsky & McGrath, 2008; Kardong-Edgren, Starkweather, & Ward, 2008; Nehring; Lashley, & Ellis 2002; Nunn, 2004; Peteani, 2004; Rhodes & Curran, 2005; Thompson & Bonnel, 2008). Due to the volume of literature on



all aspects of simulation, this literature review of current use is limited to nursing education. It will include descriptive articles on simulation programs, review articles, and research studies.

The literature on simulation use in nursing education can be broken down to several different categories. The categories include general concepts of use that correspond to the concepts of Jeffries model of simulation such as best educational practices (Bremner, Aduddell, Bennett, & VanGeest, 2006; Johnson, Zerwic, Johnson, & Theis, 1999; Leigh, 2008; Medley & Horne, 2005; Nunn, 2004); outcomes (Alinier, Hunt, Gordon, & Harwood, 2006; Radhakrishnan, Roche, & Cunningham, 2007); simulation design, implementation, and evaluation (Jeffries, 2005, 2006, 2007); and the physical design of the physical space (Jeffries, 2006; Rothgeb, 2008). There is a large body of literature that discusses the advantages and disadvantages of simulation (Bearson & Wilker, 2005). Some literature also exists that described the adoption and integration of a program of simulation (Curtin & Dupris, 2008).

Approximately 50 articles were reviewed regarding simulation use in nursing programs. A matrix table (Table A1) of the classic and current literature relating to simulation use, focused on programmatic simulation use. This group of articles range in dates from 1999 to 2009. The purpose of this specific review was to understand more discretely what the structure, processes and outcomes are in the specific literature. This section of the literature will discuss the important structures and processes. Best practices and outcomes of simulation use will follow in the next several sections. Concepts peripheral to the structure, process and outcomes that support simulation use in the school of nursing such as the advantages and disadvantages are also discussed.

Important structural features examined in the literature describe the physical, personnel, and financial resources that aid in establishing simulation use within a school of nursing (Jeffries, 2006; Johnson, Zerwic, & Theis, 1999; King et al, 2008; Nehring, Ellis, & Lashley, 2001; Nehring & Lashley, 2004). Most nursing programs need to consider a redesign of space to fully engage simulation use. Financial concerns are frequently described (Curtin & Dupris, 2008; Nehring & Lashley, 2010). Financial resources seem appear to be the deciding factor for deciding to purchase simulators, they need upkeep and maintained as well. Many schools have used grants and anonymous donors to purchase the machines (Nehring, Ellis, & Lashley, 2001).

Processes schools use to adopt, implement, and use simulation within the school of nursing are based in the schools curricular framework and philosophy of education. The process include such things as faculty training to use the new technology; purposes for simulation within the school; as well as the specific uses the nursing programs. Faculty needs continuing education, mentoring, and encouragement to use simulation. Initiating changes in your teaching and using technology can require extra time and financial resources from the nursing programs. Most literature describes that best practices includes having a dedicated person to introduce, coordinate, and run the evaluation of the program of simulation within the school of nursing (Jeffries, 2006; Kardong-Edgren et al., 2008; King et al., 2008; Nehring & Lashley, 2004; Ravert, 2010; Pilot Study, 2009). Implementation of simulations varies depending on the theoretical framework used by the school of nursing (Bearson & Wilker, 2005, Henneman & Cunningham, 2005; Jeffries, 2006; Jeffries, 2006; Nehring, Ellis, & Lashley, 2001; Nehring, 2010b). Simulations are used in a variety of courses to teach a variety of skills and content (Arlinier et al., 2006; Brannan, White, & Bezanson, 2008; Childs & Sepples, 2006; Dearman,

2003; Feingold, Calauce, & Kallen, 2004; Henneman & Cunningham, 2005; Henneman et al., 2007; Jarzemsky & McGrath, 2008; Jeffries, 2006; Thompson & Bonnel, 2008).

**Best practices in simulation.** The use of simulation has given faculty a unique way to solve many of the problems in nursing education. High-fidelity simulations have been reported to give students the perception of “real life” situations. Simulations can be used to reinforce didactic material, to expose students to clinical experiences they may only have the opportunity to read about, or in place of or enhancement of the clinical experience when there are limited clinical placements (Johnson, et al., 1999).

More specifically, simulations engage students in situations where they can practice assessment skills; prioritize, implement, and monitor interventions; communicate with clients, family, and other members of the health care team; function in highly complex situations; and finally practice clinical decision making (Kardong-Edgren, Starkweather, & Ward, 2008; Nehring, Lasley, & Ellis, 2002; Nunn, 2004; Peteani, 2004; Radhakrishnan, Roche, Cunningham, 2007; Rhodes & Curran, 2005; Rystedt & Lindstrom, 2001; Seropian, 2003; Seropian, Dillman, Lasater, Gavilanes, & Driggers 2004a, 2004b; Thompson & Bonnel, 2008). Simulations have been used to teach key concepts such as patient safety (Henneman, Cunningham, Roche, & Curnin, 2007; Henneman & Cunningham, 2005) and critical thinking (Medley & Horne, 2005; Johannsson & Wertenberger, 1996). The major conceptual outcomes that have been measured in simulation research are increases in student self-efficacy (Leigh, 2008) and self-esteem. Additionally, simulations give the faculty the opportunity to solve clinical instructor/ preceptor issues, as multiple students can get experiences in a very short period of time (Hovancsek, 2007; Nehring & Lashley, 2004).

Simulations have been reported to have been integrated in single courses as well as across curriculums (Kardong-Edgren, Starkweather & Ward, 2008; Nehring & Lashley, 2004; Peteani, 2004). It is important to consider that simulations should be leveled based on the level of the course, the level of the student, and the objectives of the course. Successful integration is dependent on several key components: clear articulated learner outcomes; clear connection between the course/clinical objectives; and debriefing (Bremner, Aduddell, Bennett, & VanGeest, 2006).

In 2004, Nehring and Lashley reported a study that looked at simulation use in nursing. They surveyed 210 nursing programs, simulation centers and other institutions of higher education who had received METI human-patient simulators<sup>TM</sup> that provided nursing education through simulation. The 40 respondents reported on curricular use of simulation, faculty time and use of simulation, student opinions on simulation (21 of the schools reported), and ownership and placement of the HPS. They found that the main reasons faculty were embracing this technology was the ability to encourage students to use critical thinking and reasoning skills through synthesis of previously learned skills and didactic information (Nehring & Lashley, 2004).

Simulation technology is constantly changing and becoming more affordable for the academic programs. The perceived ease of use may be changing as well as the technology advances. Many of the new simulators take far less time to program and set up. The newer technology even has some built in monitoring devices to help faculty track student performance easier. Current literature also describes the methods for obtaining, implementing and using simulators as a methodological instrument based on the experiences of individual institutions of higher education.

However, with changes in simulation technology, and increased use, the decreasing numbers of nursing faculty, decreasing educational budgets, and shortages of nurses it is important to determine the current state of use of simulation technology within nursing programs. The use of simulation technology is complex and multifaceted. Understanding the use of simulation technology is important to help with establishing best practices in simulation technology (Bremner, et al., 2006). The reality of larger institutions may be hard or unrealistic to obtain for smaller or more isolated nursing programs, or those nursing programs who were not early adopters of this technology. Recently a study discussed the implementation of simulation programs on limited budget (Curtin & Dupuis, 2008).

**Simulation use outcomes.** The last step in the simulation process is evaluation. Evaluation by both faculty and students becomes a multi-level, appraisal of the learning experiences. The Education Practices in Simulation Scale (EPSS), was developed to evaluate the “educational practices embedded within a simulation” (Jeffries, 2006, p. 173). This scale measures four dimensions of best educational practices: active learning, collaboration, and diverse ways of learning and high expectations as based in Chickering & Gamson’s seminal work( Jeffries, 2006). The EPSS has been tested in a multi-site study, and has a Cronbach’s alpha of .92 (Childress, 2005; Jeffries, 2006). Additionally, Jeffries has developed the Simulation Design Scale (SDS), which is used to evaluate the simulation design. The SDS was also tested in the multi-site study, Cronbach’s alpha is reported as .94-.95 (Childress; Jeffries).

Student evaluation of the simulated learning experiences can occur through formal evaluative processes as well as informal discussions. It has been reported that old and new knowledge is learned and reinforced during a simulated learning experience and is equivalent to learning it in a didactic setting, but will be retained for a longer period (Bruce, Bridges, &

Holcomb, 2003; Fuszard 1995). This can be evaluated summatively through formalized educational testing (Jeffries, 2006). Formative evaluation occurs after the experience with written or oral feedback by the students regarding the created learning process, how it can be improved, and if it was indeed beneficial for student learning. Several authors have reported high levels of student satisfaction with simulated learning experiences (Engum & Jeffries, 2003; Jeffries, Woolf, & Linde, 2003; Johnson, Zerwic, & Theis, 1999).

**Advantages and disadvantages of simulation.** Multiple benefits result from the use of simulated learning experiences. These tangible and intangible benefits help not only students, but faculty and society as a whole. The use of simulation involves active learning which in turn “increases knowledge, communication skills, motivation, confidence, and affective learning” (Nehring, 2010b, p. 9). Simulations have been shown to improve clinical judgment and critical thinking. It allows for greater standardization of clinical experiences across a curriculum, while at the same time providing immediate feedback to students about their clinical performance (Nehring, 2010b). More recently simulation has been used as a way to increase teamwork between intra- and interdisciplinary teams (Lasater, 2007; Messmer, 2008).

Perhaps the most important use of simulations documented in the literature is the increase of clinical judgment, critical thinking and reasoning. Clinical judgment is composed of critical thinking and clinical reasoning. Critical thinking has been the outcome measure of several simulated learning experience studies (Johnson, et al., 1999; Rhodes & Curran, 2005), and has been defined as the ability of “skillfully analyzing, synthesizing and evaluating the information gathered from or generated by observation, experience, reflection or communication as a guide to belief or action” (Rhodes & Curran, p.257). Critical thinking is gained through experiential

learning and is refined through the reflective process that follows the simulation. Practice allows the student to become more proficient in this practice.

There are disadvantages to the use of simulations that are documented as well. Simulation technology can be intimidating and implementation as a teaching method can be time intensive (King, Moseley, Hingenland, & Kuritz, 2008; Nehring, Ellis, & Lashley, 2001). Detailed business plans are needed to sustain simulation use within nursing programs. Not only does money need to be allocated to purchase the expensive simulators, secure space needs to be dedicated to house the simulators, and ongoing maintenance needs to be considered in the overall costs of implementing simulations. Personnel need time for training and to develop simulations for their individual classes, or a specific faculty member needs to become the simulation champion helping others use the simulators (Jeffries, 2006; Ravert, 2010).

**Importance of simulations in nursing education.** The evolution of healthcare in general and the changing nature of nursing education have led to a greater need for the implementation of simulations. An increasing need for quality and safety in health care; shortages of not only clinical faculty but of clinical sites for the students; and the change of patient acuity in hospitals has led educators to want new ways of educating students. Educators have renewed their interest in simulator development and use in nursing education. The safety of the created clinical experience allows the students to practice clinical judgment skills, performance skills, and communication skills in a safe environment. This safe environment protects not only the student and faculty, but society as well. The student is free to make decisions, whether right or wrong, and learn from the positive as well as negative consequences of their decisions. Mistakes are not fatal for patients, and students have more freedom to try novel approaches to clinical situations (Henneman & Cunningham, 2005; Henneman, Cunningham, Roche, & Curnin, 2007).

Performance skills can be concretely measured and quantified. The measurement of performance skill is important in today's technologically advanced health care environment. Students are expected to know how to work, and have experience with complex machines. Skilled communication is another one of the highly esteemed competencies in our current health care environment. Through the simulated learning experience the student is able to practice more complex interdisciplinary communication skills. Through the practice and performance of these skills the students report increased self-confidence in their clinical capability (Bearson & Wilker, 2005; Breannan, White & Bzanson, 2008; Feingold, Calauce, & Kallen, 2004; Jarzemsky & McGrath, 2008).

As detailed in Chapter 1, clinical nursing education has been forced to look for alternative educational methodologies due to uncontrollable changes in increasing patient acuity, shortages of available clinical sites, and increasing faculty shortages. Simulation is one of the newer teaching methodologies used to meet these critical issues in nursing education (Tanner, 2006).

**Nursing educational standards about simulation.** The importance of simulation in nursing education cannot be understated. There is a general lack of information regarding how simulators and simulations are being implemented and used in nursing programs who offer registered nursing education. There is little specific information regarding the diffusion of the simulation across curricula. This makes it difficult for future academic nursing programs who wish to initiate the use of simulation within their programs to not only make decisions about which simulator is the best for them, but how to integrate simulation technology into the curriculum as well as individual courses (N.M., personal communication, October 19, 2007).

The agencies that evaluate and accredit nursing programs such as the American Association of



Colleges of Nursing(AACN), the National League of Nursing (NLN), different state nursing associations, State Boards of Nursing (SBN), and the National Council of State Boards of Nursing(NCSBN) struggle with how to regulate the use of simulation technology within individual nursing Programs (N.M., personal communication, October 19, 2007). The accrediting agencies are not only looked upon as the regulators of policy, but often they are turned to as advisors for the nursing programs for which they are responsible.

Nehring (2008) reported on the state of regulation of the use of simulation by State Boards of Nursing. Nehring surveyed all 50 State Boards of Nursing, the District of Columbia, and Puerto Rico in 2006 and found that “five states and Puerto Rico had made regulation changes to allow for such substitution” (substitution of simulation hours for clinical hours) (p. 109), and “only Florida has indicated a percentage of 10% (p. 115)”. Most states have loose interpretations of specific clinical ratios and hours. Most dictate ratios of approximately 1 instructor to every 8-10 students. Two states have set standards for the number of clinical hours (California and Colorado). Likewise two states have guidelines regarding the percentage of clinical hours that must be in an actual clinical setting. In the states of Florida and Hawaii,  $\geq 50\%$  and  $\geq 40\%$  respectively of all clinical rotations must be in actual clinical settings. Approximately 19 of the responding states were currently considering simulation regulation, and were watching with increasing interest what is occurring within nursing programs regarding the use of simulation.

Only two studies exist that globally describe the use of simulation by nursing programs. The first is a limited study that looked at nursing programs, simulation centers, and allied health facilities using Meti simulators (Nehring & Lashley, 2004). The second examined the state of regulation by State Boards of Nursing in the United States and Puerto Rico (Nehring, 2008). No established instrument exists to survey nursing programs regarding simulation use. The

development of the Use of Simulation and Technology (UST) scale was driven by the author's interest in better understanding current use of simulation within nursing programs, the choices nursing programs are making regarding simulation technology, and other forms of technology nursing programs are using to create simulated learning environments.

### **Developing a Framework to Examine Simulation Use in Nursing Programs**

The use of technology becomes important as a basis for understanding the use of simulation. If a school of nursing has adopted other forms of technology for use in their school, it might signal their readiness to adopt simulation technology. The measurement of certain programs can best be accomplished by using a framework that is derived from Donabedian's framework for assessing quality of the health care system – structure, process and output (Donabedian, 1980; Donabedian, 2003; Handler, Issel, & Turncock, 2001; Upenieks & Ablew, 2006). The structure – process – output of an academic program influences both faculty and students.

Over thirty years ago Avedis Donabedian developed a framework to ensure quality in health care organizations based on the structure, processes and outcomes of some set of measurable objectives or criterion (Donabedian, 1980; Donabedian, 2005; Perrin, 2002). He developed the framework based on an evolving definition of quality. Quality was defined as “value judgments that are applied to several aspects, properties, ingredients or dimensions of a process” (Donabedian, 2005, p. 692). More generally, it is thought to be what is valued in an organizational structure that influences the processes of organization in order to achieve the desired outcomes. What is valued by the organization becomes the objective criteria that are measured during evaluation of the process and outcomes.

The structures of a school of nursing are generally the stable structures (e.g. human, physical and financial resources) of an academic institution that support the process of the institution giving it the ability to achieve its academic goals. Generally structural components are tangible assets of the organization (such as employment statistics, the physical characteristics of the academic institution, and the financial resources) (Donabedian, 1980; Upenieks & Ablew, 2006). The structure includes any specialized resources the institution possesses in order to meet the challenges they face to continue providing high levels of quality education. The structures of a school of nursing support the processes that allow for the implementation simulation.

Processes are described as the mechanisms that guide the development of educational programs within a school of nursing so that their organizational goals can be met. Processes are ongoing and constantly being redefined based on the organizational needs. The processes related to simulation technology use are the general and specific factors that support its adoption, implementation and use at a school of nursing. These include items such as faculty involvement, training and their use of simulation technology (Donabedian, 1980; Upenieks & Ablew, 2006). The processes ultimately lead to the outcomes obtained from the simulation technology use.

The desired outcomes from simulation use have been to “replicate some or nearly all of the essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for real in clinical practice” (Morton, 1997, p. 76). Simulation technology gives nursing faculty the ability to provide the students with clinical experiences that may not occur frequently, or that have a high risk of poor outcomes. Students can also practice basic skills, demonstrating competency while caring for patients. Other benefits that are just being explored are the ability to give students opportunities to interact in multidisciplinary situations, or to practice emotionally complex care situations, improving their communication

within the health care environment (Gaba, 2004). The structure and process determines the outcomes that can be measured. Ultimately, the outcomes that nursing programs are hoping to obtain from simulation are highly competent, capable nurses who provide high quality, safe care to multiple clients in a variety of situations. Nurses who can function and communicate within the health care team, and who possess a wide variety of technical and non-technical skills (AACN, 1998; IOM, 2003).

## **Conclusion**

The use of simulation has increased in nursing education. Research in simulation has had mixed results. The differences between groups that have used simulation and those who have not have increased psychomotor ability and self-confidence in clinical ability (Bearson & Wilker, 2005; Feingold et al., 2004; Jeffries & Rizzolo, 2006; Johnson, Zerwic, & Theis, 1999; Rhodes & Curran, 2005). Student satisfaction and increased interest in learning has been positively reported (Bearson & Wilkerson, 2005; Bremner et al., 2006; Jeffries & Rizzolo, 2006; Kardong-Edgren, Starkweather, & Ward; 2008; Medley & Horne, 2005; Nehring, Ellis, & Lashley, 2001). nursing programs that use simulation often struggle with implementation – some report that the simulator sat in the box while they were trying to figure out development and implementation of simulations (Kardong-Edgren et al. 2008).

Research has reported use related to discreet courses and across curriculums. Several reference books have described how to design, use, implement and evaluate simulations, and how to prepare the simulation space (Mayes, 2010; Spunt, 2007). State Boards of Nursing and the National Council for the State Boards of Nursing have begun to examine the use of simulation by nursing programs (Nehring, 2008). One study described simulation use to date

(Nehring & Lashley, 2004). The study completed in 2002, described those schools that had purchased Meti human patient simulators<sup>TM</sup>. Simulation technology has changed significantly and the use has increased since 2004. In order to establish the best practices the use of simulations as well as how outcomes are being measured needs to be examined. The USTI will provide information necessary to help determine the future of simulation use in nursing education.

## **Chapter III: Survey Development and Methodology**

### **Introduction**

The challenges in nursing education have supported the exploration of new instructional methodologies. As the use of human patient simulators in nursing programs has become more widespread the necessity to understand current use as an educational method has increased. Ultimately, this may help educators, administrators, and regulators make informed decisions regarding the use of human patient simulators. The purpose of this study is to describe the use of simulators in nursing programs. Prior to conducting the study the Use of Simulation Technology Inventory (USTI) was developed and pilot tested. Part 1 of Chapter Three describes the survey development, pilot study findings, and results of the content validity assessment. Part 2 of Chapter Three is the description of the methods used for the dissertation.

### **Part 1: Survey Development**

#### **Purpose of the Survey**

An extensive literature review revealed only one study directly examined the use of human patient simulators in health care education, and no specific instrument that examined the use of human patient simulators in health care education (Nehring & Lashley, 2004). Therefore, the Use of Simulation Inventory (USTI) was developed based on current simulation literature to answer the research questions (Sim & Wright, 2000; Waltz, Strickland, & Lenz, 2005). The survey's purpose was two-fold: to describe the processes and structures used by nursing programs when adopting simulation technology, and to begin to determine the outcomes that are being obtained as well as the outcomes nursing programs are hoping to achieve from simulation

technology use. The survey was structured using the three domains of Donabedian's structure, process, and outcomes framework (Donabedian, 2003).

## **Survey Development**

After an extensive literature review, items were developed for the USTI to reflect the constructs of structure, process and output. Initially, 39 questions were developed to describe the stable characteristics of an academic program or the *structure* of the school and simulation use within the school of nursing. The stable characteristics were described as the human, physical and financial resources needed to support simulation use by the school of nursing. Specific items described the numbers of employed professionals, their training, qualifications, the physical size of the institution: the number of buildings, the equipment they possess, geographic location, and proximity to other collaborating institutions; the financial resources that an academic program has available for educational courses, technological equipment, physical environments, and professional development that is used to train employed professionals not only as educational specialist, but also as technological specialist in order to use new technology (Donabedian, 1980; Donabedian, 2003; Upenieks & Ablew, 2006).

The 29 items that described processes of the academic program are those things that convey how the institution is organized to accomplish its work in relation to simulation use. Six items described the governance structures, educational pedagogy and learning theories, academic program offerings and the type of research the school undertakes. The rest directly described the processes and structures of simulation use including who is in charge of the simulation program, how many faculty have experience and use simulation at the school of nursing; in what courses and content areas they are using simulation at the school of nursing; the specific structures used

to design and implement the simulations such as how long do the simulations last, do they use debriefing, how long does debriefing last, faculty support for simulation use, and the effect of simulation use on the curriculum.

Outputs or *outcomes* of academic institutions are described as the ways nursing programs measured success and were considered a measure of the effectiveness and efficiency of the academic nursing program. Outcomes related to simulation cannot be directly attributed to participation in the simulation, as it would infer causation. Eight items were developed to measure academic outcomes of the nursing programs. In nursing programs academic outcomes could be directly measured through student state board pass rates. Indirect outcomes can be measured through student satisfaction with curricular offerings. Seven of the eight items were questions regarding student satisfaction with simulation; what student outcomes do they hope to achieve from implementation of simulation within the nursing program; and what lessons they learned during the implementation of simulation within the school of nursing.

A total of 76 open and closed ended items were developed and sequentially ordered based on the theoretical framework to obtain detailed and definitive answers to the research questions which were aimed at understanding how human patient simulators are being used in nursing programs (Sim & Wright, 2000; Waltz, et. al, 2005). All items were then secondarily reviewed by the co-chairs of the dissertation committee, who are experts in nursing education. The items were edited to ensure that they represented the three domains (structure, process, and outcomes) and grammatically corrected. After IRB approval, a pilot study was conducted to assess face validity prior to the full dissertation study.



## **Pilot Study**

### **Purpose**

The USTI was piloted to determine face validity. Establishing the face validity of a survey establishes whether or not items and instructions are appropriate, understandable, redundant, misleading or unclear. Additionally, face validity serves to determine if the information obtained is consistent, or if the items generated spontaneous or extra answers (Thomas, Hathaway, & Arheart, 1992; Waltz et al., 2005). The pilot study was also used to describe the use of simulation and technology in nursing programs in Kansas.

### **Research Questions**

The research questions that guided the pilot study were: 1) How do subjects evaluate the ease of completion, and clarity and readability of item wording of the UST? 2) How do subjects rate the relevance of the items to their own experiences with use of simulation and technology in their school of nursing? 3) Are there additional items that should be included in the instrument to more fully capture the structure, process and outcomes of use of simulation and technology in schools of nursing? 4) Based on responses to the instrument, how is simulation used in schools of nursing in Kansas? 5) What are successful practices in simulation in schools of nursing in Kansas? 6) What barriers or problems are reported in the adaptation and use of simulation and technology in schools of nursing in Kansas?

## Results

**Sample.** The target sample for the pilot study was faculty or staff from 18 Nursing Programs who attended a simulation conference sponsored by the Kansas Board of Regents in Wichita Kansas in March/April 2008. Each school was invited to participate in the pilot study by completing and evaluating the USTI. Participation was strictly voluntary and implied consent for participation.

Pilot study participants represented five of the 18 schools attending the conference. Four of the five participants who completed the survey were faculty, with one being an administrator as well. One participant was a staff member. Three of the five respondents had been in their current position less than fifteen years, the other two participants greater than twenty years. Four of the five programs led to degrees resulting in eligibility to sit for licensing exams for registered nursing. Four of the respondents were from nursing programs offering Associate Degrees in Nursing. One of these also offered a Practical Degree in Nursing as well. The fifth respondent was faculty at a program offering a Bachelors Degree. The nursing programs admitted between 64 to 140 students per year, graduating between 60 to 80 pre-licensure candidates. Schools had between five to twenty faculty members with master's degrees, and up to eight faculty with doctoral degrees.

**Questions 1 – 3 results: participant evaluation of the USTI (Face Validity).** The participants gave little feedback regarding the ease of use of the survey. The majority of the information from the survey came from the answers to the survey questions. The majority of participants reported that the survey accomplished its goal which was to describe the structures and processes that support the adoption and use of human patient simulators within a school of

nursing, as well as outcomes from the use of human patient simulators within the nursing programs. They reported that the survey contained questions that contained verbs that were in three different tenses, as well as questions that asked about past, present and future actions. While they reported this was necessary to ask the right questions, they reported the organization was confusing. They also reported that the survey needed to be narrowed to simulation use, and that technology use needed to be removed. The respondents reported that the survey was comprehensive and that more questions were not needed. The USTI took respondents between one to three hours to complete.

Based on participant responses, the dissertation committee co-chairs, and the student researcher rearranged the questions so that they were organized according to verb tense under the appropriate headings. An effort was made to remove the majority of technology questions except those that had some bearing on simulation use, based on literature review. While the length of time it took to answer the survey could be perceived as a barrier in obtaining responses, the actual time to complete the survey might be less since it will be delivered electronically. The time it takes to complete a survey can increase the “perceived costs” of completing the survey resulting in decreased return rates (Dillman, 2007, p. 18).

#### **Question 4 Results: Simulation use in Kansas Nursing Programs.**

*Structure of simulation use in Kansas Nursing Programs.* Successful practices in simulation not only support their use, but lead to good outcomes for the students. The faculty reported on the structures and process that supported the use of simulation and the outcomes they are measuring and achieving. Each school reported the exact numbers of simulators (Table 1).

Table 1

*Numbers of High and Low Fidelity Mannequins by Pilot Study Respondent*

Respondent	Adult High-Fidelity	Child High-Fidelity	Infant High-Fidelity	Noelle/OB	Low-fidelity/ Static Mannequins
1	2	0	1	0	40
2	2	0	1	2	6
3	2	0	0	0	15
4	7	2	1	1	1
5	2	0	1	2	0

The number of simulators included their low-fidelity simulators such as Vital Sim™, complete care dolls, pediatric complete care dolls, static manikin, static infants, Vital Sim Annie™, enema simulator, cath sims, wound care, surgical safety, Chestor Chest™, Inject-A-Pad™, Noelle™, intravenous arms, and decub models. The nursing programs had several different high-fidelity simulators, four of the five had Laerdal™, one had a Meti™ simulator and three of the five had Gaumard™. The respondents reported that a variety of monies was used to purchase their simulators, including institutional funds, donated funds, grant funds, and other miscellaneous money.

Only two of the respondents had designated space just for the simulators. Simulators in the other three institutions shared space within the lab, and did not have their own designated space. All five respondents reported that the spaces the simulators were to be used in were not ready when the simulator arrived. One reported that they were still attempting to obtain space

from the department for the simulator and that the space had not been preplanned. The rest were in the process of remodeling the space.

Respondents reported that it took up to 12 months for the first simulation to occur. One respondent reported that initially the simulator was only for health assessment, and that it did not become fully integrated until the lab coordinator was hired. Another respondent reported that the simulator was functional right away, but was not incorporated into the curriculum for at least a year. Half of the respondents stated that they either used faculty-developed scenarios or a combination of preprogrammed scenarios. Three of the five schools reported that they used a standardized simulation scenario form published on the Kansas State Board of Nursing website when developing scenarios for their simulations. A respondent reported that they used their simulators “on the fly” for over one and a half years because of the steep learning curve on the programming, and it took a considerable amount of time to write, develop, and research the case studies for the scenario development.

Despite frustrations with simulation technology and perceived barriers to use, four of the five faculty felt that the simulators were easy to use. The one dissenting respondent stated that the faculty had not spent enough time with the simulators to understand how to use them. It was felt that if the simulator was all set and ready to use the faculty were more receptive to use. One institution reported that a core group of faculty could handle the technology, but that they had not volunteered to assume the technology role of simulation programming. Simulators are complicated pieces of equipment that can occasionally need repair. Respondents reported the structures in place to deal with repairs. Respondents reported that when this occurred they just stopped the activities, they used a different simulator, or that they still used the simulator just didn’t turn it on.

***Processes of simulation use in Kansas Nursing Programs.*** Process used by the academic institutions varied greatly. A majority of the schools used a combination of educational pedagogies such as constructivism, adult learning theory, experiential learning and brain based theory. The frameworks that supported their philosophy, mission and educational pedagogies ranged from eclectic to concrete nursing theorists. They included wellness-illness, stress adaptation, nursing process, Watson, and Maslow's hierarchy. Four of the five schools supported continuing education along with their basic nursing education. Faculty at four of the five institutions were also involved in research, but only one of the five reported simulation research as a means to evaluate the simulations or to improve them.

Four of the five respondents reported that one person was in charge of the simulation program, this being the primary responsibility for three of the four. It was reported that the one program that had no coordinator was poorly organized. Up to four faculty at the institution were experienced with simulations.

Simulations were used primarily for the faculty to observe student knowledge and skill. Three of the five used simulation for baseline skill assessment, two of the five institutions used simulation to evaluate the clinical objectives, and only one of the five used simulation for the evaluation of program objectives. All five respondents reported that simulation was used in health assessment, medical surgical nursing, pediatrics, obstetrics and gynecology, while three of the five also reported critical care nursing. Two of the five respondents stated that simulation was used in psychiatric nursing. Other areas that used simulation were pharmacology, ethics, capstone and leadership. They reported using the clinical simulations for approximately up to 20 clinical hours. Only one of the five schools reported including other allied health students with the nursing students. Four of the five schools shared the simulators with allied health schools

even though they owned the simulators and paid for all of the maintenance and upkeep of the simulators.

All five respondents reported that the students were arranged in teams of four to seven students per simulation experience. Three of the five assigned student roles such as charge nurse, family, staff, certified nursing assistant, medication nurse, or treatment nurse. The roles changed for each simulation so they have different experiences each time. Three of the five institutions captured the simulations on video tape. The simulations lasted between thirty minutes to two hours, followed by ten to 20 minutes of debriefing.

Faculty received training to develop and run simulations in a variety of ways. Two of the five institutions had received formal Laerdal™ training on site, with one including advanced scenario writing. Some faculty had attended a variety of conferences, including Kansas Board of Regents workshops. The remaining had been trained by the simulation coordinator. This was either done individually or in small groups but was reported to be a continual process with frequent reorientation. All of the respondents were members of the Kansas Board of Regents Simulation Modeling User Group (SMUG) with whom they communicated on a regular basis, shared information, and supported each other in their simulation use. The majority of respondents felt that simulations significantly increased faculty workload, preparation for clinical and laboratory preparation times.

### **Question 5 Results: Successful practices and outcomes of simulation in Kansas**

**Nursing Programs.** Faculty felt that greatest incentive to simulation use by faculty was financial reward and the perceived usefulness, followed by personal recognition by others. Student feedback and demand was only important to two of the five respondents. Only one

respondent received adjustments in workload for simulation use. Only one perceived the simulators easy to use. The respondents reported several things that engaged faculty in simulation use. Faculty reported that this gave them an opportunity to observe their clinical students, viewed simulation as an adjunct to clinical experience not a replacement, and simulation could be used as remediation of clinical skills, or as clinical make-up. They also felt that there was a push from the lab coordinator and the administration to use the simulators. Several respondents reported that their students loved simulation and requested more of it. Making use of available resources was another reason for continued simulation use, as well as the tightening of available clinical sites from competitive institutions and restrictions placed on institutions by accrediting bodies.

Outcomes are measured as program outcomes and evaluation of simulations. Outcomes measured by the institutions were skill testing, clinical evaluation activities, interactive computer activities, NCLEX scores, and computer testing. The respondents stated that they evaluated each simulation, actually testing the content. Feedback from the students came from observation, discussions, and end of the semester evaluations.

Board pass rates of schools leading to pre-licensure registered nurse degrees were between 80 and 90 percent. The respondents ranked outcomes according to what the institution hoped to achieve. These were to acquire knowledge through experiential learning, to improve skill performance, and to improve critical thinking skills. Four out of five reported that they hoped their students acquired experiences with teamwork and communication. Three out of five hoped that the students felt more comfortable and satisfying with simulations as well as satisfied. Only one institution hoped that the students could transfer skills to the use of an electronic health



record. Not one school chose increased patient safety as a simulation outcome they hoped to achieve.

Three of the five respondents reported that their students were satisfied with the simulations. One reported that their students were not satisfied. Respondents whose students were satisfied stated that the students felt the simulations were realistic and that they helped them connect concepts to actual patient cases. They liked being in smaller groups, with smaller student to faculty ratios, and enjoyed the safe environment where collaborative learning could occur. The students were satisfied with the feedback they received. Dissatisfaction hinged on the fact that the students wanted a greater number of simulations and an increase in simulation fidelity.

**Question 6 Results: Barriers to simulation adoption or use in Kansas SON.** The greatest perceived barrier to simulation use was faculty time, followed by financial restraints, skill and knowledge regarding the use of simulation, and workload issues. The greatest financial barrier to simulation use lies in the fact that four of the five schools used grant or donated funds to purchase the simulators, and three of these five do not have sustainable monies to support the simulation programs.

The respondents were asked to share any advice they would give to schools implementing high-fidelity simulations. They felt that the schools should just jump into the simulations; don't let them sit in the box. They reported that students would embrace the simulations, and the more frequently the simulations were run student satisfaction and comfort would increase. They felt that one person should be designated as the coordinator of the simulation lab. This person would be a go-to-person for the faculty. They reported that when implementing simulations start at the easiest place within the curriculum (type of scenario, level

of student, etc.) was best for success. They recommended collaboration with the skills laboratory and others to develop more realistic scenarios, because the realism (fidelity) is critical. They also noted that you need an open sharing person so that simulators are well used, making sure scheduling is flexible, because staffing of the simulation lab is critical for use. A final point is that simulation is not the same as clinical experience, instead it is a unique blend of classroom, skills laboratory, and controlled clinical experiences.

## **Discussion**

**Face Validity.** Participants of the pilot survey were asked to give feedback regarding the face validity of the USTI. Face validity, while not a true measure of validity, is important as it can be an indication of whether or not respondents will fill out the instrument (Polit & Beck, 2008; Waltz, et al., 2005). The pilot study participants gave feedback that led to changes in the USTI. Verb tenses and organizational structure were changed to be more respondent friendly. Questions were removed regarding technology use other than human patient simulators. The length of the survey was examined, and the decision was made not substantially change the length of the survey. The survey will be delivered electronically so the time it takes to complete the survey may be an overestimate of time to complete.

### **Pilot Study Descriptive Discussion.**

**Structure.** The structure of the nursing schools had an influence on simulation use in the nursing programs. Those schools that embraced experiential learning theory and valued critical thinking initiated their simulation programs sooner. Nursing Programs that had full administrative support not only had more simulators, but faculty was encouraged through intrinsic and extrinsic rewards to incorporate simulations into their courses. Budgetary concerns

were another structural issue due to the fact that most of the schools had no money budgeted to support their simulation program once grants expired.

***Processes.*** Nursing Programs who had designated specific individuals as simulation coordinators had more success at not only initiating simulation, but incorporating it throughout more courses within their curriculum. The program that used simulation the most had more faculty that were familiar with the simulators and were actively engaged with incorporating simulation into their courses.

The structures of the individual simulations were literature based and incorporated common simulation components: pre-simulation planning, the simulation, debriefing, and some kind of reflective activity. Debriefing was often times the reflective activity and the one thing that was identified as the most important. Most of the respondents debriefing were discussions of what actually occurred, what could have occurred, and how to consider alternatives.

***Outcomes.*** All nursing programs have evaluative measures as outcomes for students and courses. The literature has identified that measuring simulation outcomes is important in understanding if the use of simulations are beneficial to educational outcomes. Evaluation of simulation use should include a process for evaluating the adoption and implementation of simulation across the curriculum. The process should be included as a part of the total program evaluation.

Currently, it is difficult to directly measure student outcomes from simulation use. No current measures exist that are able to show the direct benefits of simulation use. Student evaluation of the effects of simulation on their education has been surveyed. Student satisfaction with simulation use is the outcome reported most often. It has been reported in the simulation

literature that students are highly satisfied with simulation use, and felt that faculty should use simulation more than they did. The goals of the simulations were that students would acquire knowledge through experiential learning, that the students would improve skill performance, critical thinking, and would acquire more advanced communication and team work skills. None of the nursing programs measured whether or not simulations had an impact on student outcomes.

### **Content Validity**

Content validity indexes are used to assess item and scale content validity. The item content validity index (I-CVI) can be used to determine if items included in the survey represent the survey content domains and thus relevant for inclusion on the final survey (Lynn, 1986; Polit & Beck, 2006; Waltz, et al., 2005). A score for each item should not be lower than 0.78. A total scale content validity index (S-CVI) is a computation of proportion of the number of items rated as relevant or very relevant by the experts. A computational rating of 0.80 for an S-CVI is acceptable (Lynn; Polit & Beck).

Content validity of the USTI was completed using a process described by Lynn (1986) and Waltz, et al. (2005). The procedure for a CVI involves having experts judge survey items as to their applicability to the survey development objectives and their relevance to that objective. Three experts are the minimum recommended for the assessment of content validity (Lynn, 1986). Three experts in simulation and nursing education were identified and asked to complete the content validity (Waltz, et al., 2005; Sim & Wright, 2000). The first expert was an associate professor and directs a clinical education center. Her area of expertise was student psychomotor skill acquisition and transfer of laboratory skills leading to clinical practice; she also co-founded

the *International Nursing Association for Clinical Simulation and Learning*. The second expert was a Dean of Instructional Technology who coordinates a large simulation laboratory shared by nursing, allied health, and a major hospital. The final expert was an assistant professor in nursing at a local college who is involved in the skills acquisition of undergraduate nursing students. She has used simulation as an active faculty member for over 5 years.

Clear instructions for the content validity judgment process, along with the survey were sent to the three content experts. The three content experts were asked to assign each question to the instrument objectives reflective of the three content domains, and then rate their relevance to that objective. The following objectives were used for the survey development and the CVI:

1. To identify the characteristics of nursing programs who are and aren't adopting simulation technology.
2. To understand how nursing programs obtain and support simulation technology.
3. To understand the barriers and incentives for use of simulation technology by nursing programs.
4. To understand and describe the processes that nursing programs use to support simulation use.
6. To describe simulation use in the nursing programs.
7. To describe simulation research done by faculty in nursing programs.
8. To identify and describe how nursing programs are using simulation to support educational outcomes.
9. To determine whether or not nursing programs are evaluating educational outcomes related to simulation use.

A four point rating scale was used to help the experts rate the relevance of the question to the instrument objectives and conceptual content. The rating scale was 1) not relevant, 2) somewhat relevant, 3) quite relevant, and 4) very relevant. See Table 2 for the CVI results.

Table 2.

*Pilot Study CVI Results*

Survey Question	Judge 1 Rating	Judge 2 Rating	Judge 3 Rating	Item CVI
Structure				
1	4	1	4	0.66
2	3	1	4	0.66
3	4	4	4	1.00
4	2	2	3	0.33
5	3	3	3	1.00
6	3	2	3	0.66
7	3	2	4	0.66
8	2	1	3	0.33
9	2	1	3	0.33
10	4	4	4	1.00
11	1	1	2	0.33
12	2	2	4	0.33
13	2	1	3	0.33
14	3	2	4	0.66
15	3	3	4	1.00
16	4	3	3	1.00
17	4	4	4	1.00
18	4	4	4	1.00
19	4	4	3	1.00
20	4	4	4	1.00
21	4	2	3	0.66
22	4	2	4	0.66
23	4	1	2	0.33
24	4	4	4	1.00
25	4	3	4	1.00
26	3	4	4	1.00
27	3	2	3	0.66
28	2	4	4	0.66
29	2	4	4	0.66
30	3	2	4	0.66
31	3	4	4	1.00
32	4	4	4	1.00

33	4	4	3	1.00
34	4	4	4	1.00
35	3	3	4	1.00
36	4	4	4	1.00
37	3	4	4	1.00
38	4	4	4	1.00
Process				
1	4	4	3	1.00
2	2	4	4	0.66
3	3	4	3	1.00
4	4	4	4	1.00
5 This question was deleted prior to the CVI being completed. There is not a CVI score				
6	3	4	4	1.00
7	4	4	4	1.00
8	4	4	4	1.00
9	4	3	4	1.00
10	3	2	4	0.66
11	4	4	4	1.00
12	4	4	4	1.00
13	4	4	4	1.00
14	4	3	3	1.00
15	4	4	3	1.00
16	4	4	3	1.00
17	4	4	3	1.00
18	4	4	4	1.00
19	4	4	3	1.00
20	4	4	4	1.00
21	4	4	4	1.00
22	4	4	4	1.00
23	4	2	4	0.66
24	4	2	4	0.66
25	4	4	4	1.00
26	4	4	4	1.00
27	4	3	4	1.00
28	4	4	4	1.0
Outcomes				
1	3	4	4	1.00
2	4	4	4	1.00
3	4	4	4	1.00
4	4	4	4	1.00
5	4	4	4	1.00
6	3	4	4	1.00
Total	63/72 = .87	54/72 = .73	70/72 = .97	0.90

Content validity indexes were calculated for each item on the survey (I-CVI), a total was obtained for each rater, and a total for that survey (S-CVI) (Waltz et al., 2005; Polit, Beck, & Owen, 2007). The CVI for each item reflects the relevance of each item as rated by the experts. All items with a score below 0.66 were examined for relevance to the concept of structure, process, or outcomes. The items with a CVI of 0.33 occurred in the structure section of the survey.

The total relevance ratings for each rater was 0.9, 0.73, and 0.97 respectively using computational procedures for CVI (Polit & Beck, 2006). The CVI for each rater indicated how each rater felt the survey measured the concepts it was designed to measure. The scale content validity for the survey was .90. A combined computational CVI of greater than .80 is acceptable for a new survey (Polit & Beck).

The survey was then reviewed by the co-chairs of the dissertation committee and the student researcher; decisions were then made about each question. Questions 1- 6, and 11 - 14 in the structure section of the survey were moved into an introductory demographic portion of the survey. Questions 7 - 9, from the structure section were eliminated to delete redundant and non-relevant questions even though they received favorable ratings. The other questions that did not rate well were kept based on their relevance in the literature. Question 19 was reworded so that simulation was defined. Questions 21 and 22 were rewritten to define high- and low- human patient simulators. Question 27 – 31 were redesigned to ask timing in three month intervals. An open ended question was added to the process section to help the respondent clarify for the student researcher what took place during the time frame of receiving the simulators and when they were first used. A ‘not applicable’ option was added to question 35. In the process section



of the survey question 6 was reworded to help make the question less confusing. The final survey was prepared and formatted for web-based data collection.

A new CVI was calculated after the changes to the survey were made. Individual total CVI scores for each rater were (63/67) .94, (60/67) .89, and (66/67) .98 for rater 1, 2, and 3 respectively. The total Item CVI for the scale was (65/67) .97. This new score shows an improvement in the survey's face validity.

## **Part 2: Methodology**

Part 2 of Chapter 3 was used to describe the design of the dissertation study, a description of the setting and sample, and the terms of human subject protection. The survey used for this study was described. Procedures for data collection and analysis were described.

### **Introduction**

Current literature describes was used to describe the use of simulation technology by nursing programs in individual courses (Nehring, 2010a). Outcomes from simulation technology have been discussed as well (Jefferies, 2005; Jefferies, 2006; Nehring, 2010a). Research evaluating the initiation, impact and actual use of simulation on a larger scale has not been reported in the current literature. Only one article described the use of METI™ human patient simulators in multiple settings (Nehring & Lashley, 2004). This lack of information makes it difficult for academic nursing programs to not only initiate but sustain the use of simulation within their programs. The purpose of this study was to describe the processes and structures that nursing programs leading to registered nursing pre-licensure degrees use when adopting simulation technology as well as to describe the outcomes nursing has achieved or hopes to achieve through the use of simulation technology.

## **Design and Rationale for Use**

An exploratory, descriptive design with a convenience sample of nursing programs across three Midwestern states was used to describe simulation use in nursing programs whose graduates are eligible to sit for RN licensing exams. While a formal framework for the study did not exist prior to this study, a detailed survey was developed from the literature search. Descriptive methods were used for gathering information so that a synopsis of simulation use can be compiled (Nardi, 2003). The information described in descriptive studies is generally “particular social structures, practices or process” (Sims & Wright, 2000, p. 69). In a descriptive study the variables of interest are not manipulated, thus there is no intervention in the study or controls of the variable that need to be undertaken (Sims & Wright).

Several assumptions were found to be common to all descriptive studies utilizing a survey method to collect data. The first was that patterns and commonalities were discerned regarding things respondents do. It was assumed that people tend to do similar things in similar situations. The purpose of the gathered data was aggregated to help begin discovering the structures and processes of successful simulation practices. The data was considered in a more general sense versus an individual response (Sims & Wright, 2000).

It was assumed that the respondents share a common understanding about the concepts surveyed. The respondents share a common terminology, a common frame of reference and thus do not need any intuition to interpret the survey questions. It was assumed that the respondents will respond directly what they think or feel. This allows for the gathered data to be quantified into highly accurate aggregate data to give a richer and deeper meaning to the concepts (Sims & Wright, 2000).

Finally, the last assumption was that the data collected in a descriptive survey study was non-contextual. The environmental context in which the data was collected was noncontributory to the data itself. The relationship between the researcher and the respondent, which can in many studies change the meaning of the data, had no influence in the data reported (Sims & Wright, 2000).

An exploratory descriptive study using a survey for data collection was the best research design to understand the structure, processes and outcomes of nursing programs leading to degrees that are eligible to sit for the registered nursing licensing examination. The data collected can have a significant impact on the implementation of simulation in nursing programs and across their curriculums.

### **Study Sample and Setting**

The sample for this study was a convenience sample of nursing programs whose graduates are eligible to sit for the RN licensing examination. The sample was from three Midwestern states in close proximity to the researcher. State Boards of Nursing from the three identified states were asked for assistance in identifying nursing programs for participation and a list was compiled. Seventy-six academic nursing programs were identified to participate. Initially the Deans or Chairs of the nursing programs meeting inclusion criteria were contacted via email and asked to identify the person in each school who is most familiar with simulation use. This person was invited to complete the USTI electronically.

### **Protection of Human Subjects**

Application for approval was requested from the University of Kansas Medical Center KUMC Human Subjects Committee. After obtaining IRB approval (see Appendix 6), an initial

email was emailed made to the Deans or Chairs of nursing programs who met inclusion criteria so the person within the school who was most familiar with simulation could be identified. Emails were sent through KUMC webmail so that the participants remained anonymous and the nursing programs could not be identified. Consent to participate was implied through participation. There were no known risks to the participants. Time to complete the electronic survey was estimated to be between 45 to 60 minutes, it could be burdensome to participants.

### **Instrumentation**

Since no instrument existed to measure high-fidelity simulation within nursing programs the Use of Simulation Technology Inventory (USTI) was developed based on Donabedian's structure, process and outcomes model (Appendix 2). A pilot study to obtain assessment of face validity was conducted, as well as a content validity assessment (described in Part I of this chapter). A demographic questionnaire was also developed to aid in the description of the participants. Both the USTI and the demographic questionnaire was delivered electronically through an online data collection process for the dissertation research study.

### **Instrumentation**

**Demographic survey.** The demographic survey was originally part of the USTI. It was removed from the larger survey to distinguish the content. The demographic content was used to describe the sample. The descriptive statistics such as frequencies and percentages was used to describe the type of pre-licensure nursing program, number of admissions and graduations per year, number of faculty members and their level of education, where the nursing school is located, physical description of the school of nursing, type of administration, and budgetary descriptions that help determine funding of the school of nursing (Appendix 2).

**Use of Simulation Technology Inventory (USTI).** The USTI was a three part survey that was based Donabedian's structure, process and outcomes theory (Donabedian, 2003). The survey was comprised of 39 open and closed ended items that described structures supporting simulation use, 29 items that described processes supporting simulation use, and 8 items that described outcomes of simulation use in nursing programs. The USTI was initially piloted with a convenience sample of 5 participants from 18 nursing programs. Participants who participated in the pilot study reported that the instrument was a good measure of simulation use within nursing programs (Appendix 2).

Content validity was used to assess if the individual items represent the structure, process and outcomes content domains and if the survey overall helped describe simulation use within nursing programs (see the pilot study). Items were rated on three point rating scale and items that scored 0.66 or less were examined for relevance. Overall CVI for each rater was 0.94, 0.89, and 0.98. The total scale CVI was 0.97, indicating that the instrument describes simulation use in nursing programs.

**Data collection methods.** After obtaining IRB approval, an initial email was made to the Chairs or Deans of the nursing programs who met inclusion criteria (Appendix 3a). The email contained introductory information regarding the study and its purpose (Appendix 3b). Since all data was collected electronically the email contained a hyperlink for the secure survey through the KUMC survey service. Participants indicated consent through participation. Anonymity was assured electronically; no identifying data was collected. There were no anticipated risks for participation. The researcher has not identified who participated in the study. It was anticipated that it would take approximately 45 minutes to one hour to complete the electronic survey. Data was maintained on a secure network drive at the University of Kansas School of Nursing. A goal

of 30% of the potential respondent pool was desired, which would be responses from approximately 23 nursing programs.

Lack of participant response was a potential limitation to survey research (Dillman, 2007; Polit & Beck, 2007). Reminder emails to all schools were sent every two weeks for a period of 6 weeks. Schools were also phoned to encourage participation if there were weak response rates. Phone calls consisted of clarifying who to send emails to if that was unclear. At six weeks a decision was made to re-email the pool of participants a minimum of two more times. After 25 respondents initiated responses the decision was made to terminate data collection.

### **Data Analysis**

Data from descriptive studies generally fall into two categories: quantitative and qualitative data (Sim & Wright, 2000). Data analysis centered on generating answers to each of the research questions. Data analysis began with the transfer of the data to a secure database at the Kansas University School of Nursing. Quantitative data were uploaded into a Microsoft Excel Spread Sheet. The data were cleaned prior to analysis to look for errors and missing data. Data were found missing so the percentage and pattern was analyzed to determine accuracy of the data (Polit & Beck, 2007). A decision was made to use the data as reported and to alter the respondent numbers accordingly in the results section.

The quantitative data from this study was measured at the nominal level. Nominal level data generally allowed data to be classified as descriptive data. Qualitative data collected from the open-ended questions was gathered and coded according to three themes consistent with the theoretical model apriori (Sims & Wright). The qualitative data was not as detailed or did not

have the depth of content that comes from interview or observation data gathering, but added richness to the quantitative answers provided by respondents (Sims & Wright).

***Demographic information.*** Demographic data was gathered using the demographic questionnaire and reported as a group to describe participants collectively. Demographic was classified as categorical data since it is measured nominally. The data was not reported individually so no participant could be identified.

***Research Question 1: What are the experiences and processes of the nursing programs offering RN degrees during the initiation, implementation and utilization simulation technology?*** Descriptive statistics (measures of central tendency, frequencies, and rank-ordering) and content analysis methods were used to describe the experiences and processes used at the participant schools to support utilization of simulation technology. The data came from a combination of quantitative nominal level data from the discretely answered questions and the open-ended descriptive questions. The open ended data were grouped and used to describe the sub-concepts of experiences and processes.

***Research Question 2: have the nursing programs offering RN degrees who have adopted simulation technology implemented and used simulation technology across their curriculum?*** Quantitative and qualitative data were analyzed to answer research question number two. Quantitative data was used to describe the nursing programs who have adopted simulation. Qualitative data from the open ended questions was used to describe the implementation processes used by the nursing programs when obtaining simulation technology. These qualitative data were grouped and coded into categories that were identified apriori within

the theoretical model. The three themes were structure, process, and outcomes. Implementation practices that led to better-quality practices became apparent through the analysis.

***Research Question 3: What have the nursing programs offering RN degrees experienced since the adoption, implementation and use of simulation technology?*** This research question used similar descriptive analysis procedures to describe the experiences of the SON with simulation technology since implementation. The data were a combination of quantitative and qualitative data. Quantitative data were analyzed through using central tendencies, frequencies, and rank ordering. Qualitative data that was grouped into predetermined themes based on the theoretical framework. This helped to give understanding to the experiences the schools have experienced since adopting.

***Research Question 4: What methods are nursing programs offering RN degrees using to evaluate (both formative and summative) the use of simulation technology?*** Data from the outcomes section of the instrument were analyzed to understand evaluation methods of simulation used by the participating SON. Quantitative and qualitative data were analyzed. Quantitative data were analyzed using central tendencies, frequencies, and rank ordering. Qualitative data were analyzed to add explanation to the role outcomes play regarding simulations.

***Research Question 5: What are the outcomes nursing programs offering RN degrees are experiencing since the implementation of simulation technology?*** This question was answered using both quantitative and qualitative data. Literature did not describe a wide variety of outcomes for simulation use within nursing programs. Quantitative data were analyzed using central tendencies, frequencies, and rank ordering. Questions from the USTI were



primarily open-ended. Qualitative data were analyzed to describe how outcomes can be used to tie outcomes to simulation use.

## **Conclusion**

The purpose of this chapter was to describe the methods that were used to collect and analyze the data from this descriptive study. The lack of literature describing simulation use within nursing programs has prompted this study to help begin examining which process and structures lead to better-quality simulation practices within nursing programs with regard to simulation use. Outcomes from simulation use can allow for evaluation of the processes and structures and revisions to be implemented. Descriptive data included both quantitative and qualitative data to provide rich description, which can lead to clear measures of use and evaluation.

## **Chapter IV: Results**

### **Introduction**

Multiple factors (faculty shortages, decreasing educational budgets, and shortages of clinical sites) have led to changes in how we teach nursing students. The use of high-fidelity human patient simulators during simulated learning experiences is one of the newer teaching methodologies that have helped meet the current challenges in nursing education. The purpose of this study was to describe the use of simulation technology in nursing programs leading to pre-licensure nursing degrees located in three Mid-western states.

In the results chapter the quantitative and qualitative data describing the sample demographics and the research questions are reported. The following research questions guided the study: 1) What are the experiences and processes of the programs offering nursing degrees during the initiation, implementation and utilization of simulation technology? 2) How have the nursing programs, who have adopted simulation technology, implemented and used simulation technology across their curriculum? 3) What have the nursing programs experienced since the adoption, implementation and use of simulation? 4) What methods are nursing programs using to evaluate (both formative and summative) the use of simulation technology? 5) What are the outcomes nursing programs have experienced since the implementation of simulation technology?

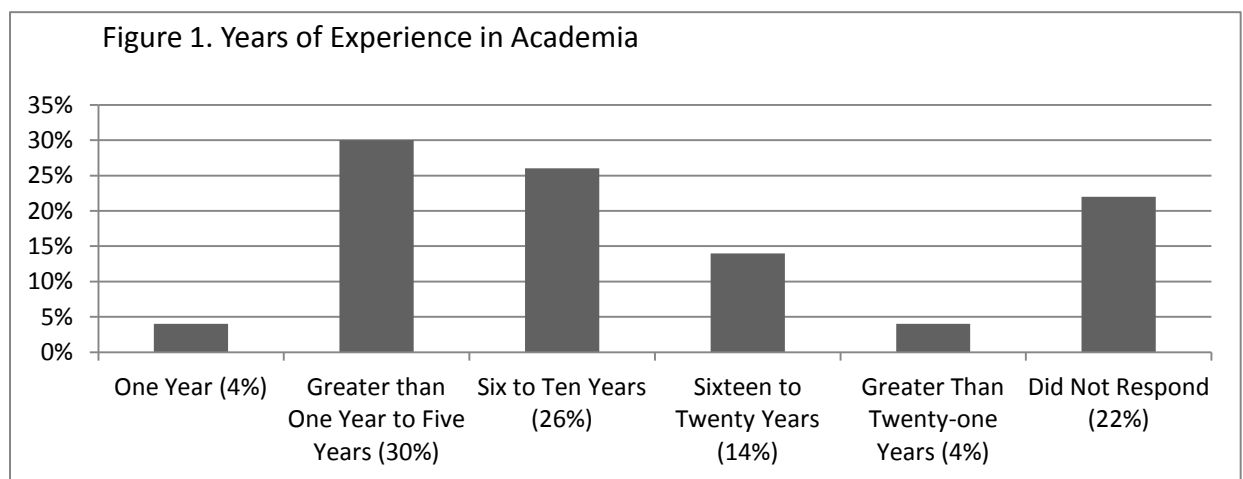
### **Demographics**

**Study demographics.** The sample pool for this study consisted of 76 programs offering nursing degrees in three Midwestern states. Each school was invited to participate via Electronic Mail (e-mail). A series of three e-mails were sent approximately 2 weeks apart. A time period of

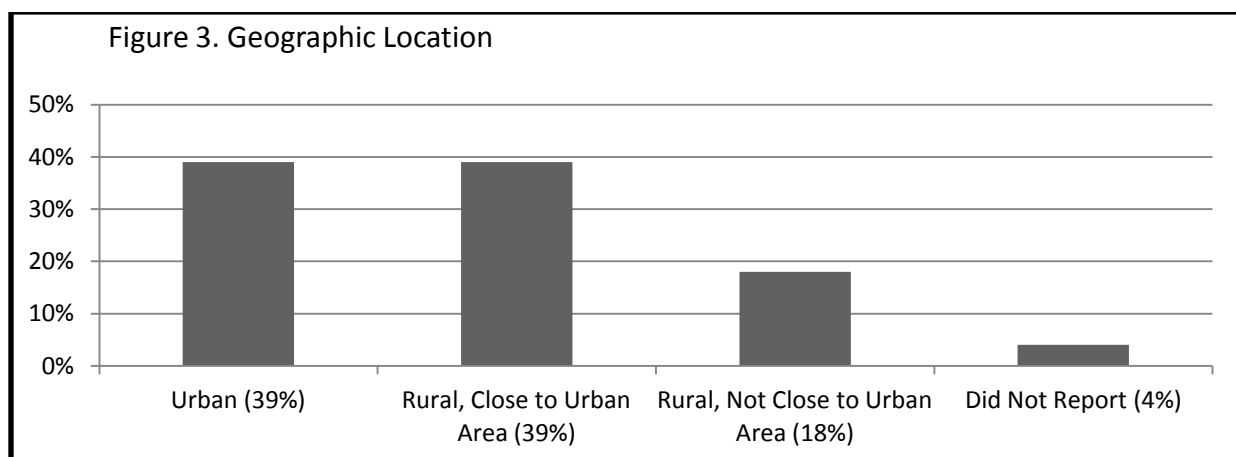
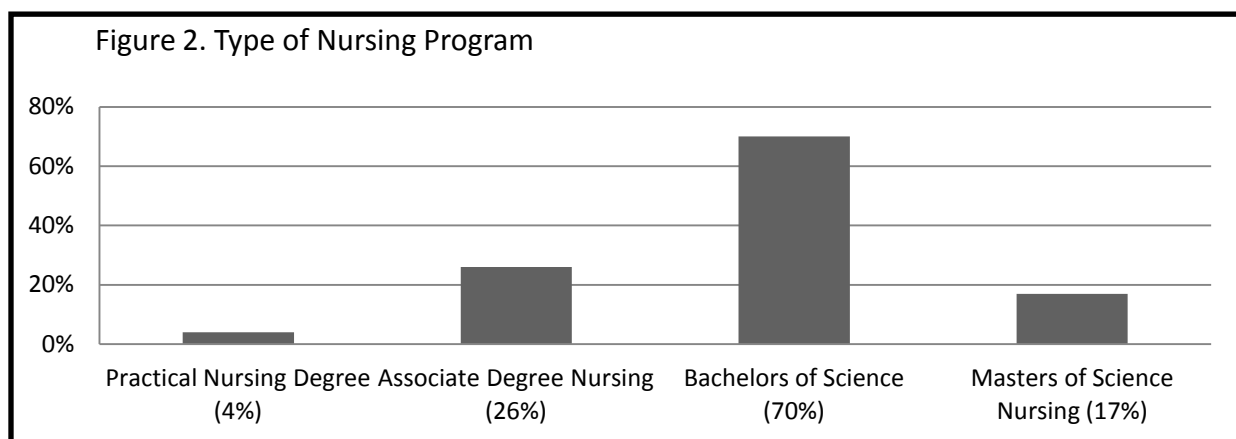
one month was allowed before two more e-mails were sent approximately 3 weeks apart.

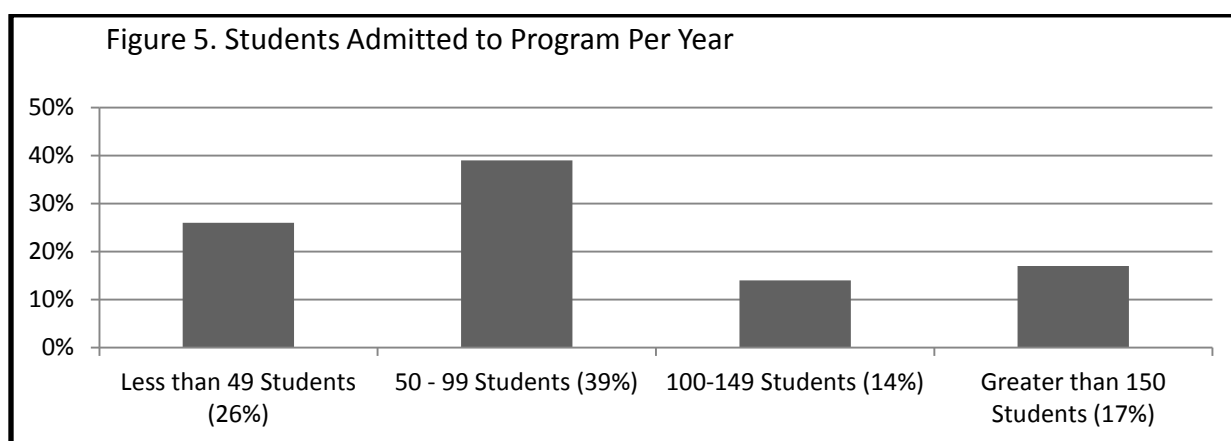
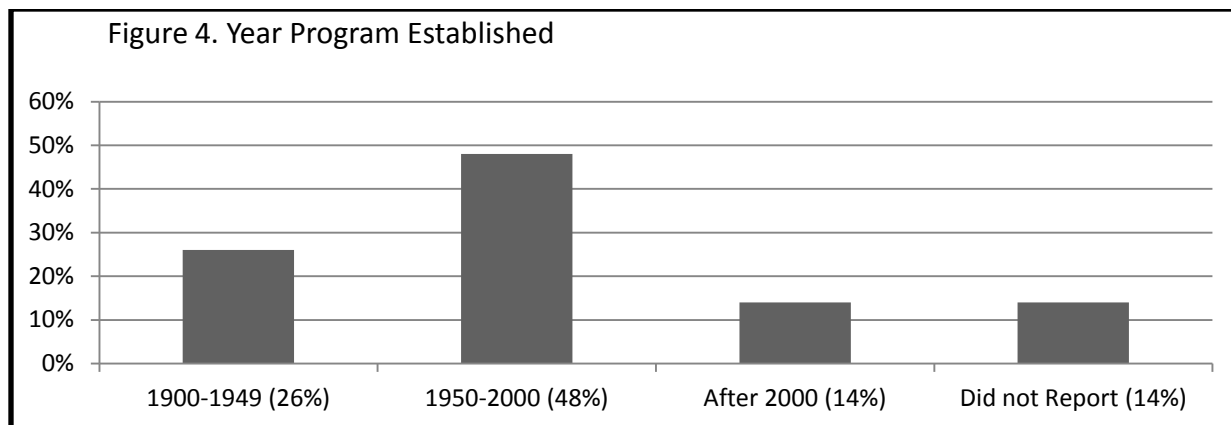
Programs were removed from the participant list if they indicated they would not respond to the survey and were not contacted again. Programs indicated that they would not participate for a variety of reasons, including they did not use human patient simulators in their school, they were in the process of implementing simulation, or that they were not interested in completing the survey. Four (17%) of the 76 invited programs indicated they would not participate. There were seven nursing programs with multiple branches. Six of the seven programs had one contact name listed, so these six programs with multiple branches were contacted collectively. Only one of the multiple branch programs had multiple contacts, and was contacted at all branches. Four (17%) of the multiple branch programs shared simulation and did not repeat offerings at all the branch schools.

Twenty-five (33%) of the 76 programs initiated survey responses and 23(30%) completed greater than 90% of the survey. The respondents consisted of three (13%) administrators, 16 faculty (70%), and five (22%) staff (several respondents held multiple roles, thus percentages add to greater than 100%). Three (13%) respondents did not answer this question. The majority of the respondents (17/ 74%) had been in academia greater than one year (Figure 1).

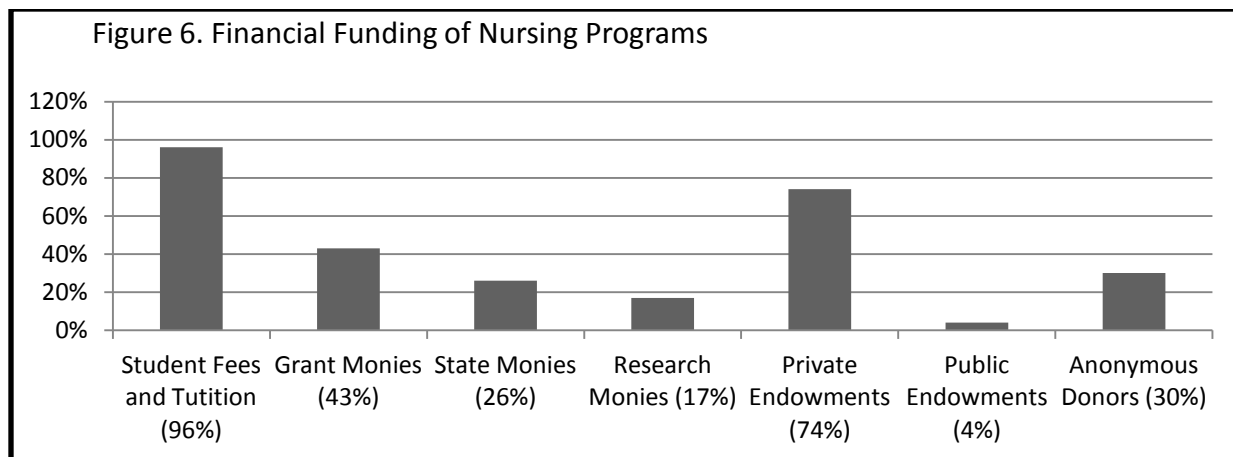


All respondents were at programs offering degrees leading to the associates or bachelors nursing degree (Figure 2). One program also offered a licensed practical nursing program. Twenty (87%) of the programs also supported continuing education. Seven (30%) of academic institutions were private, while one (4%) was public. The remaining 15 academic institutions did not indicate their institutional status. Most programs were located in urban or near-urban area (Figure 3), were established during the last half of the twentieth century (Figure 4), and admitted between 50 and 99 students a year (Figure 5).

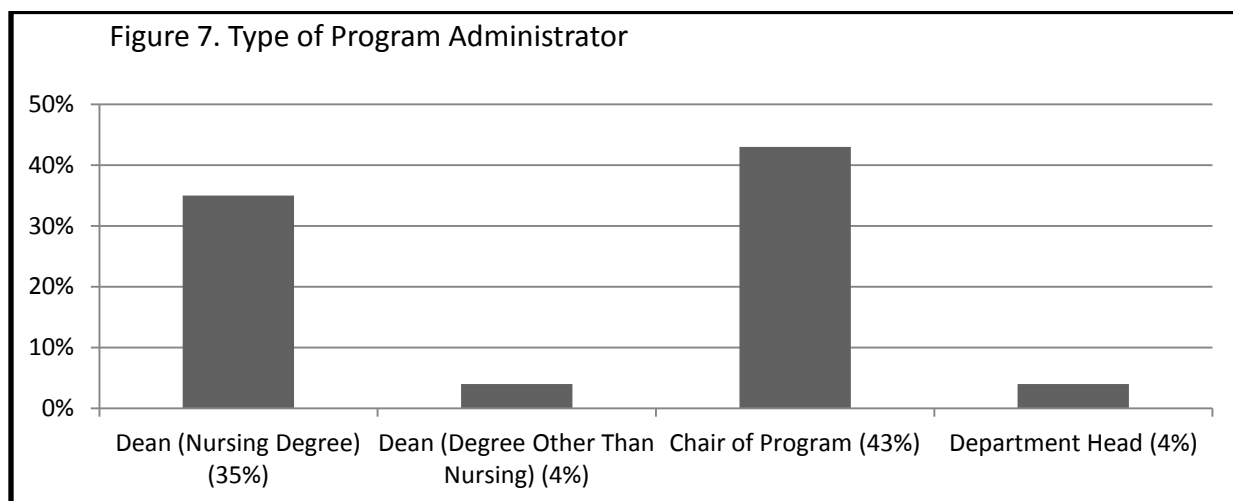


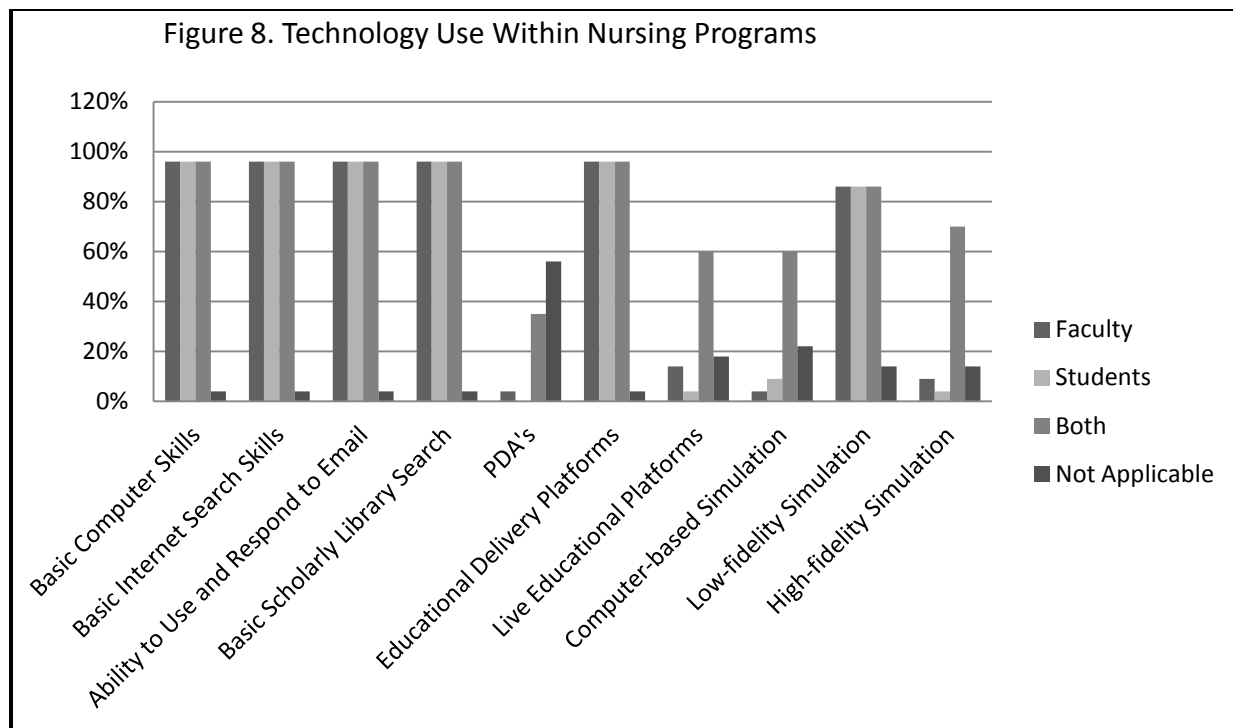


**Demographics of nursing programs.** According to the Structure-Process-Outcomes (SPO) model, the structure of a nursing program were stable physical and financial characteristics that lead to the success of the program. Ten (43%) of the respondents reported having their own building, and twelve (53%) shared a building with other disciplines or administrative services. Thirteen (56%) of the respondents reported they had room to physically expand their program of nursing, while eight (35%) did not have room to expand. The programs varied on how they obtained financial resources to support their program (Figure 6), with the majority of funding coming from student fees and tuition.



The programs had various types of administrators, with the majority having deans or chairs (Figure 7). Technology use expectations for students and faculty were determined by the types of technology used within the program. This varied from basic computer skills (MS Word, Excel, Power point); basic internet search skills (Yahoo, Google); ability to use and respond to email, basic scholarly searches, use of PDA's, use of educational delivery platforms, use of live educational platforms (Wimba, Eluminate, Synchronous Chatting, Electronic Health Records), computer based simulation, and low and high-fidelity simulation (Figure 8).





**Demographic summary.** In summary, the programs participating in the study sample shared similar characteristics. The majority offered Bachelors of Science Nursing degrees, (70%), were located rurally (57%), and were established between 1950 and 2000, and enrolled between 50 to 99 students annually. All of the nursing programs were dependent on student fees and tuition to fund their programs, followed by private endowments, and grant money. The majority of the programs shared a building with other disciplines or administration, but had room to expand their program of nursing. The majority of the programs required both faculty and students to have basic computer skills, basic internet and library search skills, the ability to use and respond to email, and the ability to use educational delivery platforms. Faculty and students were both required to understand how to use low-fidelity simulation. The majority of the respondents reported that faculty was required to use high-fidelity simulation.

## Research Questions

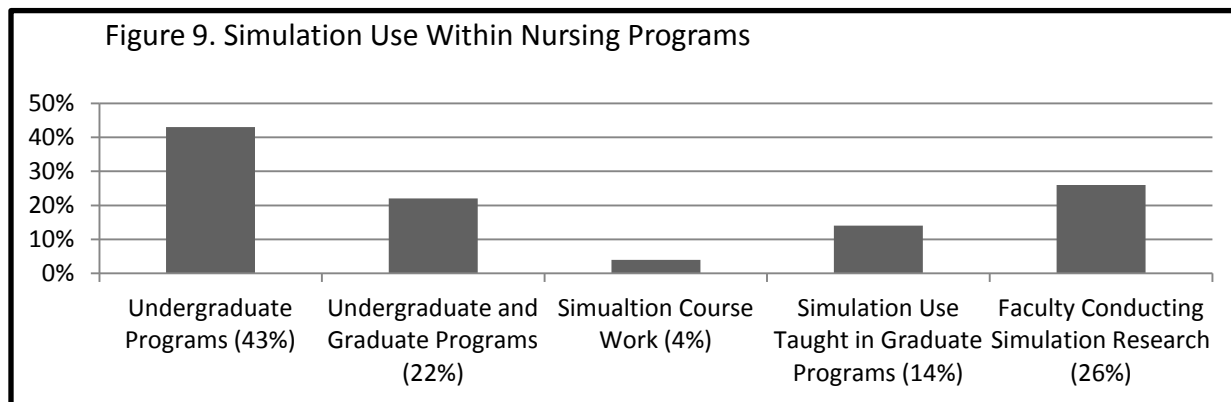
**Research Question 1: What are the experiences and processes of the programs offering nursing degrees during the initiation, implementation and utilization of simulation technology?** Respondents were asked to report on the experiences and process of their respective nursing program during the initiation, implementation and utilization of simulation technology. These results are organized according to the structure and processes framework which guided the study.

*Structure and processes of simulation use.* According to the SPO model the structure of simulation use is those stable physical and financial characteristics that support simulation use within nursing programs. These included numbers and types of simulations, financial means to purchase simulations, designated simulation space within the lab area and area related questions, as well as the incentives and barriers of simulation use as perceived by the respondents. Process is those things that guide the development of nursing programs so organizational goals are met. These included who run and organize simulation use as well as faculty training and their specific use of simulation within the academic program.

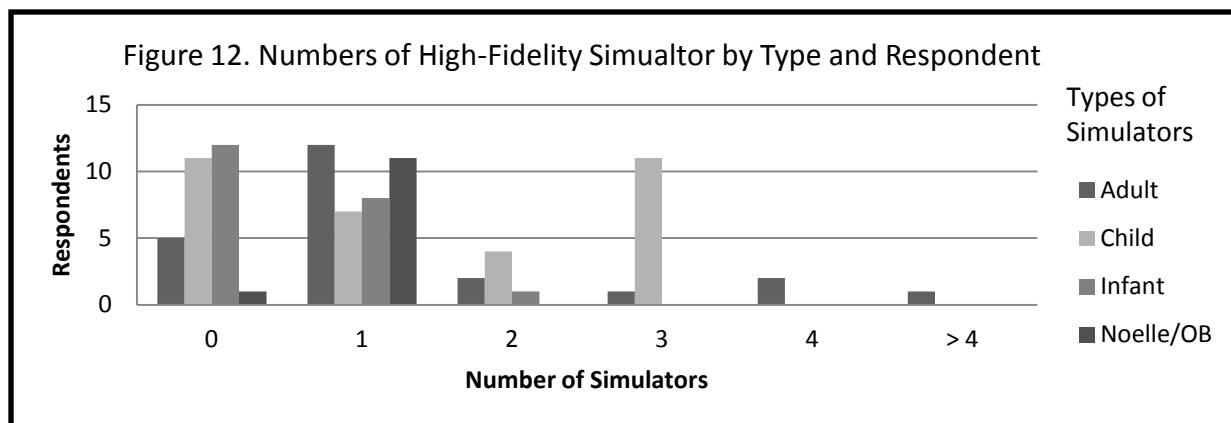
*Simulation use within nursing programs.* Use of high-fidelity human patient simulators was reported by seventeen (74%) of the respondents. The other seven (30%) respondents reported that they intended to use high-fidelity simulation experiences in the future. Respondents were asked if they used simulation in both undergraduate and graduate education, if simulation use was taught at the graduate level and if faculty were conducting simulation research (Figure 9). Simulation at the graduate level was being used in nurse practitioner, clinical nurse specialist,



and nurse anesthesia programs to manage patients, write orders, and observe medication effects.

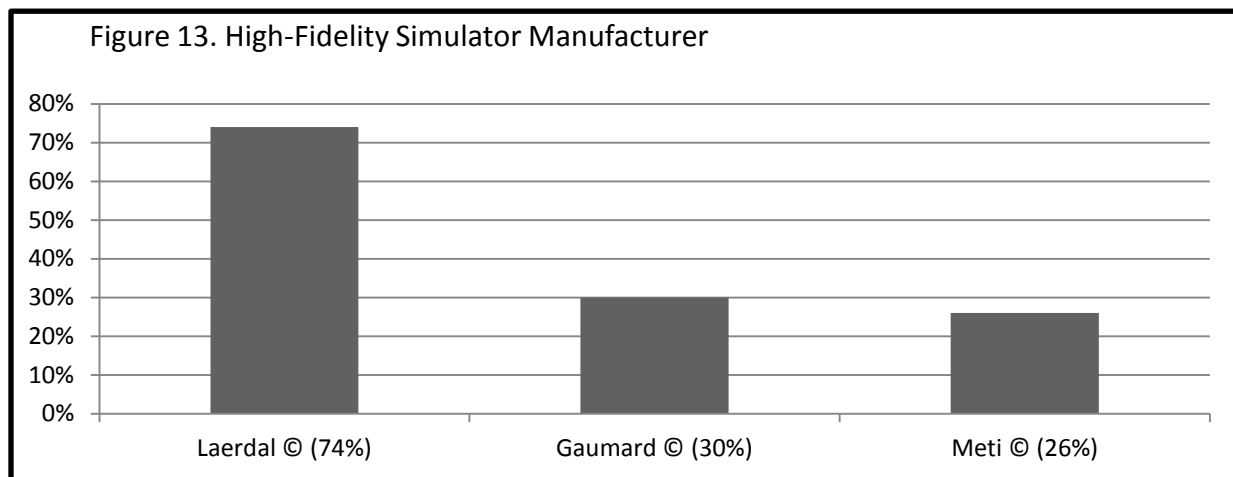


*Types of simulators.* The respondents were asked to report numbers of both low and high-fidelity simulators. Several of the nursing programs respondents reported that they did not have high-fidelity simulators. When reporting numbers of high-fidelity simulators several respondents also reported that they had vital-simulators, mid-level adult simulators, and mid-level child and infant simulators (Figure 12).

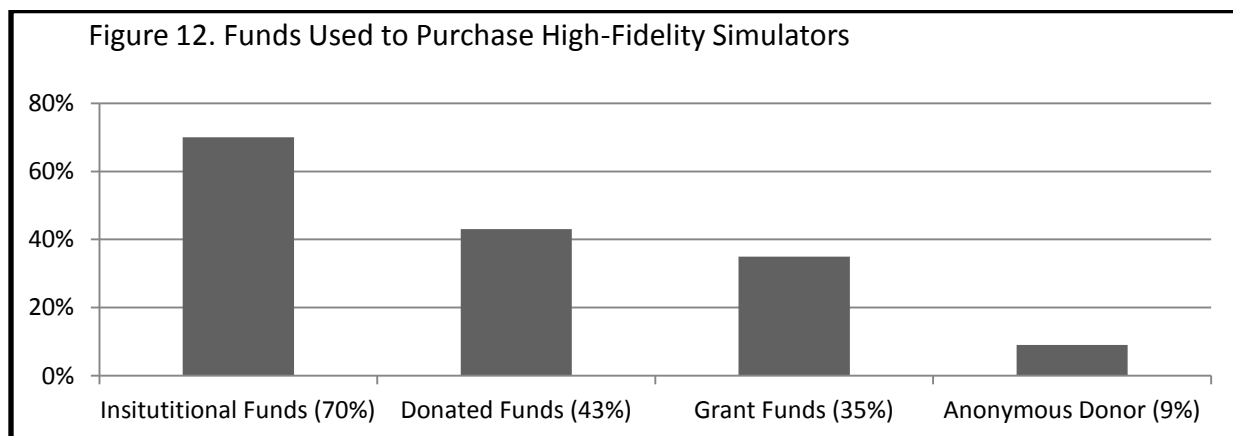


Low-fidelity simulators are primarily task trainers and respondents reported they had Nursing Anne™, Vital-Sims™, varying ages of static mannequins, Nursing Kelly™, Nursing Baby™, Vital Sim Kid™, and Convalescent Kelly™. The number of low-fidelity mannequins ranged from zero to a total of 16 low-fidelity simulators. Not all the respondents agreed on what constituted a low-fidelity simulator, in that some included vital sims in both the low-fidelity and

high-fidelity responses. The respondents were asked to report the various manufacturers of the high-fidelity simulators (Figure 13).



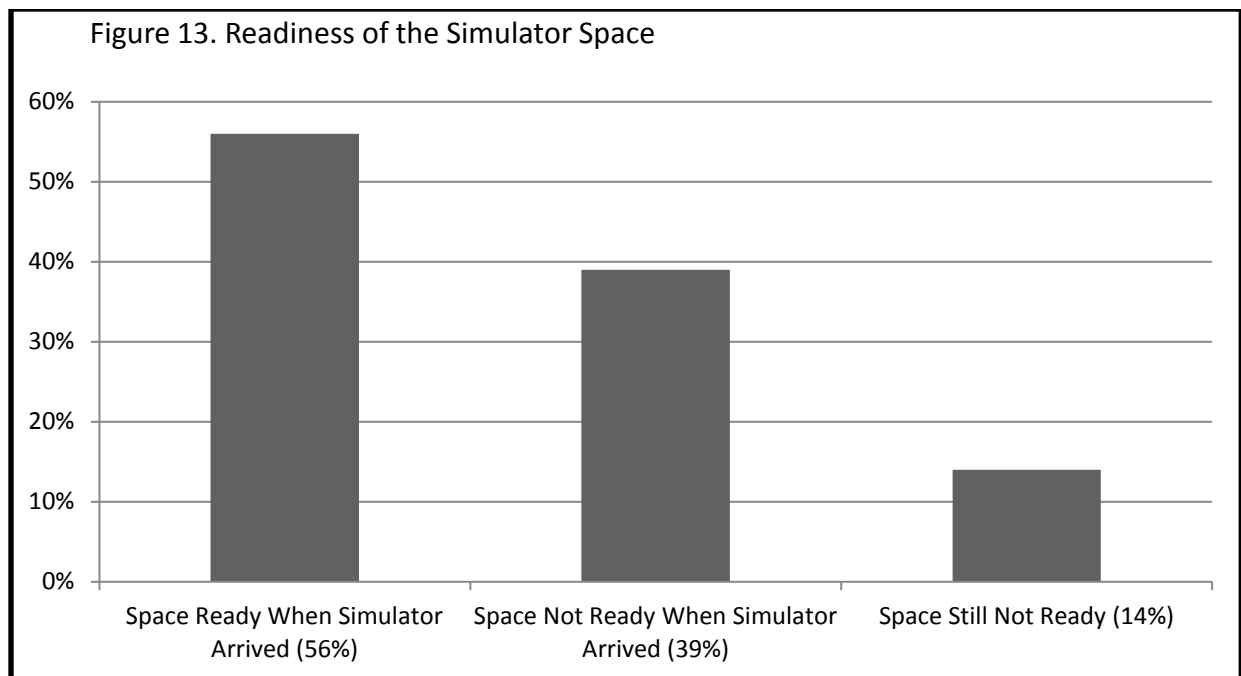
*Simulator funding.* The majority of the respondents reported that they purchased their high-fidelity simulators with institutional funds followed by donated or grant funds (Figure 12). Nine (39%) reported that they had sustainable money to continue their program of simulation use. Nine (39%) reported that they did not have sustainable money, and five (22%) did not know whether they had sustainable money to continue the program of simulation once it was started.



*Physical simulator laboratory space.* Respondents were asked to describe the processes they went through to develop their learning lab (Appendix 4), and then the simulation lab itself (Appendix 5). While the respondents reported that they had varying budgets to complete the simulation space, the processes they went through to develop the space were similar. Teams, most often led by program administrators planned the simulation space. The space was approved by institutional governance and funds procured for development. Some teams consisted of faculty and simulation companies, as well as architects. Teams used a variety of ideas when designing the space. Some had attended conferences that discussed simulation spaces; some visited other simulation centers, and still others used industry experts from the various manufacturers.

Differences in description of the process used to develop simulation spaces occurred in two groups: those who shared their simulation space with other disciplines or larger institutions, and those respondents that planned a space that was within their existing learning lab because they did not have separate available space. The planning processes varied between respondents, but the majority used a team approach to planning the space.

Descriptions of the labs were similar in that the majority of the respondents reported that their simulation space was separate from their learning lab (87%). Space varied based on numbers of high-fidelity simulators in the space. The majority of the respondents reported that they attempted to model the simulation area after patient rooms. Several gave details of wall mounts (e.g. Oxygen available in the wall, suctioning), while others discussed the rooms by the type of simulator in the room (adult, pediatric, or obstetrics). Readiness of the spaces was reported by all respondents with the majority having the space ready when the simulator arrived (Figure 13).

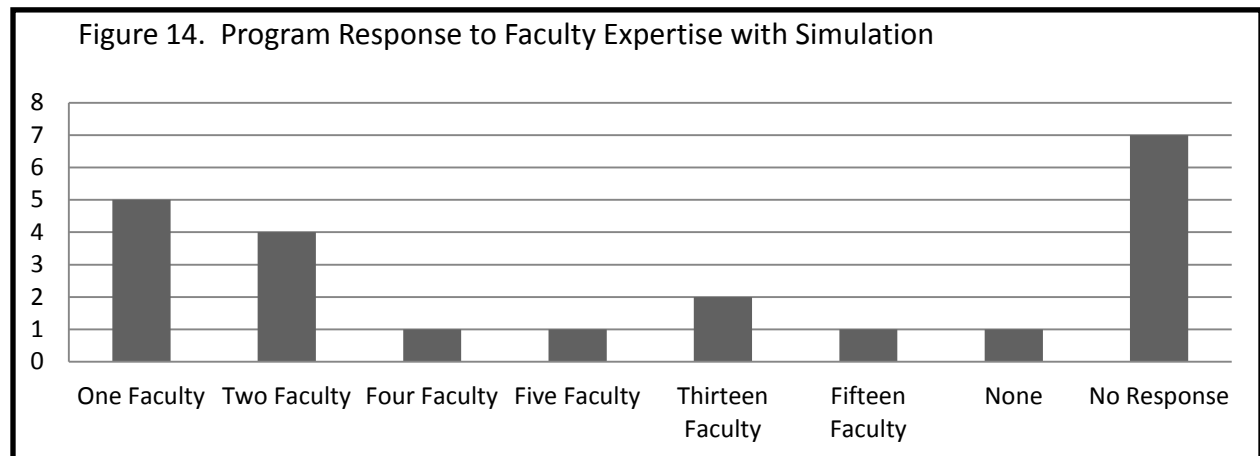


*Simulator functionality.* Respondents were asked to report if their human patient simulators were out of the box and ready to use. Fifteen (65%) of the respondents reported that the simulators were out of the box, totally functional, and being used by faculty. Seven (30%) reported that they were not ready with the following comments. One of the respondents received the simulators two weeks before. One respondent reported that they were out of the box, but not being used to their full potential due to faculty workload, time, and training on the simulators. Another respondent reported that their “Sim Man was out of service for updates”. The respondents reported on the time it took for full functionality after arrival with most reporting functionality between 0 and 3 months (Table 3). Seven (30%) of the respondents reported that faculty had previous simulation experiences, while fifteen (65%) of the faculty had no previous simulation experience (Figure 14).

Table 3.

*Simulator Functionality after Arrival*

	0-3 Months	4-6 Months	7-9 Months	10-12 Months	More than 1 year	Did not Answer
How long did it take from the arrival of your simulator(s) until they were functional?	13 (56%)	4 (18%)			1 (4%)	5 (22%)
How long did it take from the arrival of your simulator(s) to run your first simulation?	9 (39%)	2 (9%)	2 (9%)	1 (4%)	4 (18%)	5 (22%)



*Faculty simulation use.* Faculty use of simulation and high-fidelity simulators is crucial to implementation and support of a simulation program. Faculty use hinged on ease of use and training. Seven (30%) reported that faculty found the simulator easy to use, while thirteen (56%) reported that they did not find the simulator easy to use. More than one respondent reported that the technology was over-whelming, and that problem-solving the programming has been challenging; it was difficult to ensure that all aspects of the simulator were functioning as planned. Eleven (48%) reported that they had one person in charge of developing and

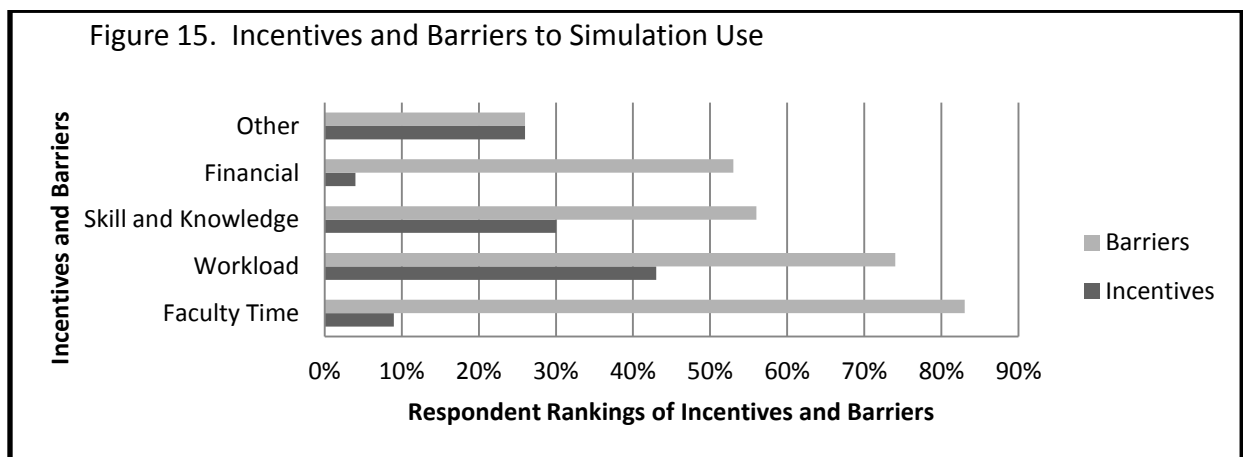
implementing the simulation program. Several suggested that the best way to increase faculty use within courses was to have one person in charge of the simulation program, and if budgets allowed to hire a technology person to run the simulator.

*Faculty training for simulation use.* It was reported that training and consistent practice time was necessary otherwise the skills and knowledge necessary to run the simulator were lost. Respondents were asked to comment on initial and on-going faculty training. Initial training was most commonly by manufacturer trainers in formal training sessions either at the academic institution or at a conference. Some faculty were trained by previously trained faculty. Several of the respondents reported that they attended a users group meeting and received basic training there. On-going training was reported by one respondent to be encouraged and supported financially. The most common ongoing training occurred in seminars, webinars, conferences, short courses, and faculty to faculty support within the institution. One respondent reported that they were sharing simulation articles currently. They had one workshop on debriefing but not many of the faculty could attend due to time constraints.

*Incentives and barriers of simulation use.* Incentives and barriers to simulation use are those things that entice or hinder simulation use. Respondents were asked to report if faculty time, workload, skill and knowledge, or financial concerns were incentives or barriers. They were allowed to list other incentives or barriers in an open-ended question (Figure 15). Then the respondents were asked to rate the incentives and barriers from the most important to the least important. The largest incentives to simulation use were quality of student experiences and satisfaction with the learning environment, as well as difficulty locating clinical locations, and the reality of giving students a safe hands on learning experience, and finally student requesting simulation. This was followed by workload and skill and knowledge. The greatest barriers to

simulation use were faculty time and workload, followed by skill and knowledge, and availability of simulation lab time.

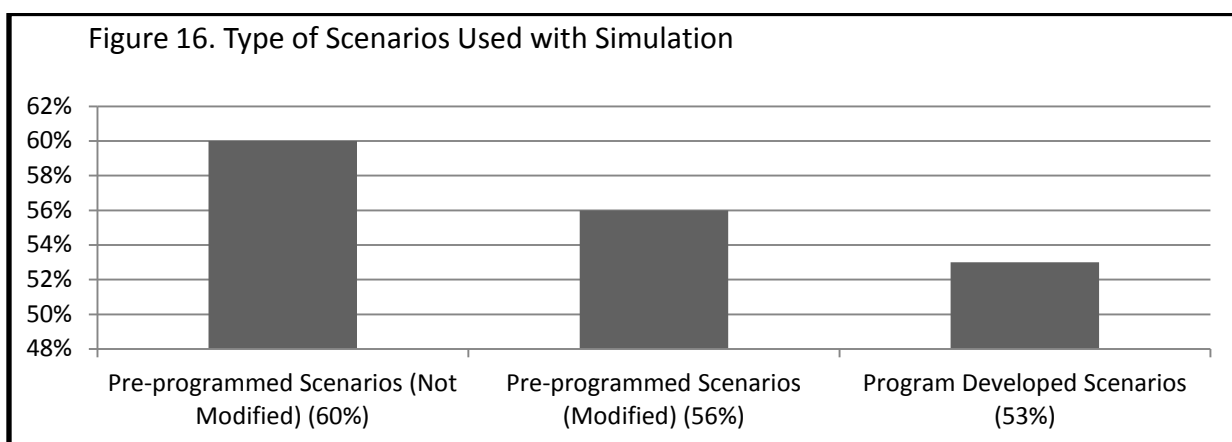
Respondents commented on what kept faculty engaged in simulation use despite the many barriers to simulation use. Respondents reported that it was the expectation of the program administrator and the large financial investment made in the simulators. The greatest motivator to keep faculty engaged was student feedback and the obvious growth and enhancement of learning. Faculty reported that the desire to improve student learning, the opportunity to offer alternative learning experiences, the ability to emphasize classroom learning, and the safe environment in which students can make mistakes and critically reflect on the mistake were reasons why they became and remained engaged in simulation use.



*Structure of simulator use after arrival.* The structure of high-fidelity simulation use within each program varied. Respondents were asked to report on who determined the structure of simulation use and then specifics of use within each program. Eight (35%) of the respondents reported that administration within the school determined simulation use, while twenty (87%) respondents reported that the faculty determined simulation use within the program of study. One

(4%) reported that simulation use is jointly determined with the collaboration of other health science schools.

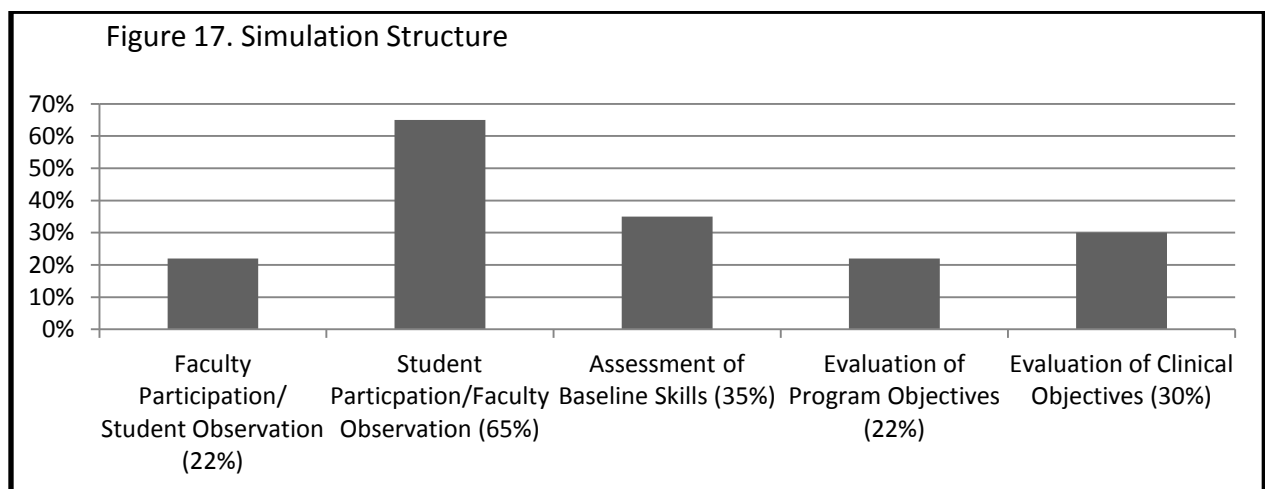
Respondents reported that they used pre-programmed scenarios with or without modifications or program developed scenarios (Figure 16). Of those respondents that developed their own scenarios greater than half of those did not use a standard template to develop the scenarios. The reason given by those programs using a standardized template for scenario development was it added more consistency to the student experience.



Simulator down-time was experienced by eleven (48%) of the respondents. The down time meant the simulator could not be used due to simulation repairs. Eight (35%) of the respondents reported no simulator use down time. They described various reasons for simulator repairs. Several respondents reported that their vendor supplied loaners so they don't have down time. The majority of the respondents reported that simulation repair rarely interfered with simulated experiences because manufacturers could loan one, they have more than one simulator, or that they run the same simulation on a static mannequin. The biggest concern was the cost of simulator repair. Several of the respondents reported that they did not have budgeted money for repair.



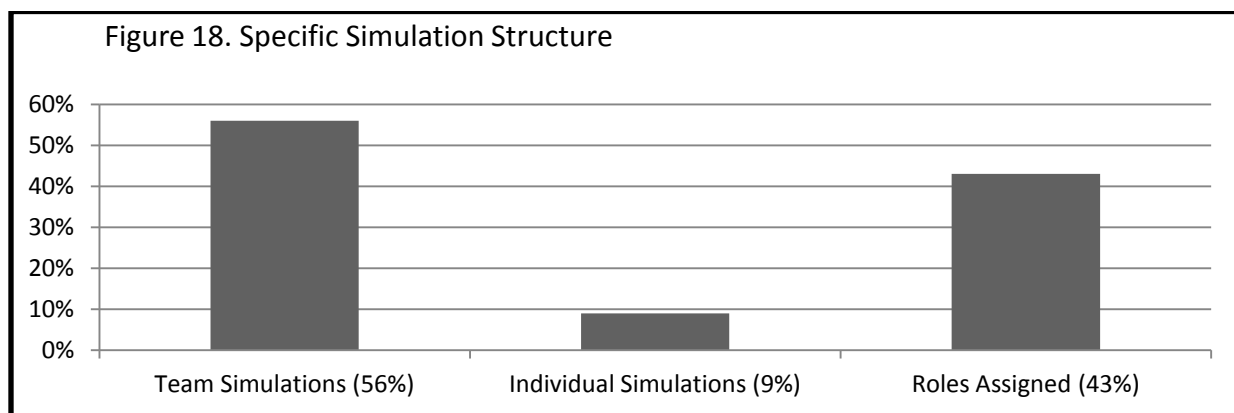
*Structure and processes of simulations within nursing programs.* The structure of simulation experiences varies between institutions and faculty. Respondents were asked to answer a series of questions regarding how they structured their simulation experiences. The majority of the respondents reported that faculty observed student participation in the simulation (Figure 18). Respondents reported that they used simulation to assess baseline skills, and to evaluate clinical or program objectives (Figure 17).



Respondents were asked if their students worked in teams or individually during the simulation (Figure 18). Those respondents, who reported that their students worked in teams, reported that the teams contained between 2 to 12 students per group. Respondents were asked if they assigned the roles to student during the simulated learning experience (Figure 18). The common roles assigned to students were primary and secondary nurses, medication nurse, procedure nurse, charge nurse, family member, doctor, recorder, and observer. The duration of the simulation experiences varied from 15 minutes to 4 hours. Thirteen (56%) debriefed their simulation experiences, while 2 (9%) reported no debriefing. Eight (35%) did not answer or know the answer to this question. Debriefing lasted from 30 minutes to 60 minutes. Video capture of the simulated learning experiences was reported by seven (30%) of the respondents.

Seven (30%) reported that the videos were reviewed with the students, and one (4%) of the respondents reported that the videos were not shared with the students.

Allied health professions participated in the simulated learning experiences of three (14%) of the respondents. Six (26%) of the respondents shared their equipment with other allied health professions. Five of the respondents reported that they had a simulation partnership outside of the nursing program. One reported that they shared with the School of Medicine, two other shared between their associated hospital with the Department of Nursing.



*Processes of nursing programs.* According to the SPO model processes of nursing programs described the organization of the institution so that the nursing program could accomplish its work. The processes are things like governance structures, academic pedagogies, and frameworks. Respondents reported varying governance structures ranging from self-governance to participative. Governance bodies included faculty senates, associate deans of colleges and presidents of the overall university. One respondent reported that students share governance of the nursing program.

Adult learning theories and experiential learning were the two most common pedagogies reported. One reported that they used Harvard DASH and debriefing with good judgment as

pedagogies. One respondent reported that they “actively support the mission of the University through our commitment to quality education, research, and service. We embrace the university values of respect, responsibility, discovery and excellence. We are committed to creating an intellectually stimulating and culturally diverse environment”. Many of the schools used multiple frameworks to guide their nursing program. Several that were listed were Institute of Medicines report on health professions education, Quality and Safety Education for Nursing, (QSEN), CCNE Essentials of Baccalaureate Education, Benner’s Novice to Expert, Communication, Care Management, Health States, and Jean Watson Caring Processes for Nursing.

*Research question one summary.* Respondents to question one reported on the structures and processes that supported programs of simulation within nursing programs. The highly related nature of structures and processes lend themselves to be reported together. The majority of the respondents reported that their program was based on an eclectic collection of theories and frameworks to support their academic outcomes and teaching pedagogies. The theories and frameworks most frequently used were adult learning theory, experiential learning theory, QSEN, IOM quality indicators, Benner’s Novice to Expert Theory, Communication theory, and CCNE Essentials of Baccalaureate Education. The majority (74%) of nursing programs were using simulation, with another 30% of the respondents planning on using simulation in the near future. Respondents reported that they were using simulation in undergraduate programs (43%). While three-fourths of the respondents reported simulation use only 26% of the respondents were conducting research on simulation use within their programs.

The majority of respondents (52%) reported that they owned one adult high-fidelity simulator; (47%) one Noelle/ OB high-fidelity simulator; (34%) one infant; and (30%) one child high-fidelity simulator. The majority of respondents reported on the varieties of low-fidelity

simulators which varied in quality and quantity. Laerdal® was the preferred manufacturer of the high-fidelity simulator by the majority (74%) of the respondents. Funding for the simulators came from more than one source, the majority used institutional funds (70%); donated funds (43%), and grant funds (35%).

Respondents described the process used to develop space for the high-fidelity simulator (Appendix 4). The majority worked in teams which included faculty, program administrators and institutional administrators. The majority (87%) reported that the high-fidelity simulator space was separate from their learning lab space (Appendix 5). This space was modeled after actual hospital rooms with 56% reporting that the space was ready when the simulator arrived. The majority (65%) of the respondents reported that at the time of the survey their simulators were totally functional and being used by faculty. A majority reported functionality after arrival between 0 to 3 months (56%). The majority (48%) of the respondents had run their first simulation within six months of its arrival.

Multiple respondents reported that faculty use of the simulators was critical to the successful implementation of programs of simulation. Faculty use hinged on three factors: ease of use, training for use of the simulation, and consistent use after training. The majority of the faculty (56%) found the simulators easy to use. Faculty received training in a variety of ways: conferences, user groups, super users, and from each other. The greatest incentives for simulation use were quality of the student experiences and student satisfaction with learning, the difficulty faculty encountered finding clinical locations, and the ability to give students a safe learning environment. The greatest barriers to simulation use were faculty time and workload, faculty skill and knowledge regarding simulation use, and the availability simulator to the faculty.

Responses to the type of scenarios used during a simulation were equally distributed with 60% reported the use of unmodified pre-programmed scenarios; 56% reported the use of modified pre-programmed scenarios; and 53% reported use of program developed scenarios. The majority (65%) of the respondents used a typical structure in which faculty observed student participation within the simulated learning experiences, with 56% reporting the students worked within teams consisting of between 2 to 12 students. Students were assigned roles 43% of the time, with common roles being: different nurse roles with varying responsibilities, family member, doctor, recorder and observer. Simulated learning experiences (SLE) lasted 15 minutes to 4 hours. The majority of the respondents reported that their SLE was debriefed and that debriefing lasted from 30 minutes to 60 minutes.

**Research Question 2: How have the nursing programs, who have adopted simulation technology, implemented and used simulation technology across their curriculum?**

*Courses using or planning on using simulation.* Respondents were asked to report in which pre-licensure clinical and non-clinical course they were using or planning on using simulation and to approximate the number of hours they used simulation in the courses. The results are reported separately within two tables (Table 4 and Table 5). Simulation was used most frequently in medical-surgical and OB courses, and those planning to use simulation most frequently reported planning to use it in their medical-surgical nursing course.

Table 4.

*Responses of Nursing Programs Currently Using Simulation Experiences*

Courses Using Simulation Experiences	Responses by Nursing Program	Hours of Simulation Experience
Health Assessment	9 (39%)	2-5 Hours
Medical/Surgical Nursing	14 (60%)	2-17 Hours
Pediatric Nursing	9 (39%)	6-16 Hours
OB/GYN	12 (53%)	6-16 Hours
Psychiatric Nursing	6 (26%)	2-4 Hours
Critical Care	9 (39%)	2-15 Hours
Pharmacology	2 (9%)	1 Hour
Ethics	1 (4%)	No Hours Reported
Capstone	5 (22%)	6-12 Hours
Others: Community Health	1 (4%)	No Hours Reported
Other: Skills	1 (4%)	No Hours Reported

Table 5.

*Responses of Nursing Programs Planning on Using Simulation Experiences*

Courses Using Simulation Experiences	Responses by Nursing Program	Hours of Simulation Experience
Medical/Surgical Nursing	7 (30%)	6-24 Hours
Pediatric	3 (14%)	6-16 Hours
OB/GYN	6 (26%)	6-16 Hours
Psychiatric Nursing	4 (18%)	4-40 Hours
Critical Care	2 (9%)	10 Hours

*Replacement of clinical hours with simulated learning experiences.* Respondents reported that they were using simulated learning experiences to replace clinical experiences. This was reported as causing significant controversy within the programs of nursing. The respondents reported that there was not clear agreement for the direct substitution of hours of simulated learning experiences to clinical hours. Seven (30%) of the respondents reported that they were substituting simulated learning experiences for clinical hours. Nine (39%) of the respondents

reported that their nursing program did not substitute simulated learning experience hours for clinical hours. Seven (30%) did not answer this question. No clear substitution ratio was being adopted uniformly by the nursing programs studied. Two (9%) used a 1:1 ratio; another respondent stated “Simulations are included as a part of the clinical experience with students having a pre-lab assignment. It is a replacing ratio in 1 course; students are scheduled for 2- 5 hour experiences in the simulation lab as a replacement for 2 days in the clinical arena”. The most common comment was that the nursing programs were substituting 1-2 days of clinical with simulated learning experiences.

*Research question two summary.* Question two asked respondents to comment on how they have implemented and used simulation across their curriculum. The majority of respondents reported that they used (60%) or were planning on using (30%) simulation within their medical surgical nursing course. This was followed by OB faculty who were currently (53%) or planning (26%) on using simulation within their obstetrical course. Other courses using simulation were skills, community health ethics, pharmacology, capstone, psychiatric nursing, health assessment, pediatric nursing and critical care nursing. Responses were almost equally split between those replacing (30%) and those who did not replace (39%) clinical hours with simulated experiences. The most common substitution ratio was a 1:1 ratio, for a total of 1-2 days of clinical.

**Research Question 3: What have the nursing programs experienced since the adoption, implementation and use of simulation?** Respondents were asked to report on their “lessons learned” from the simulation experiences. Four common themes emerged from the respondents. These included faculty engagement, simulation implementation, simulation support, and specific simulation structure.

*Faculty engagement.* Several respondents reported that the key to adoption and use of simulation was engaging faculty in the development of the simulation program and supporting the faculty in simulation use. Two respondents reported being quite frustrated with the lack of simulation use by faculty. They felt that faculty had a variety of reasons for resisting simulation use, which included not having enough time, resistance to change, and a lack of confidence in simulation to provide clinically equivalent experiences. They stated that student satisfaction with simulation and their expectations that it would be used were the key to keeping faculty engaged. They also reported that expectations by the administrator of the program encouraged faculty to engage in simulation.

*Simulation implementation.* Several respondents suggested that slow integration of simulation could lead to successful simulation programs. Start with one or two courses and then expand your simulation offerings to include other courses. Another respondent said “Just do it! Students have very positive comments about the experience and always ask for more. There is definitely a learning curve with faculty, but it’s worth it”.

*Simulation support.* Having a technical person to set up and run the simulation helps faculty, because faculty need to concentrate on the clinical coaching and teaching during and after the simulation. The technology that surrounds high-fidelity simulation is overwhelming and can over shadow the simulation experience. One respondent reported that simulations were organized chaos, and that users should learn to be flexible and always have a plan B. When using high-fidelity simulators, always have someone ready to be your patient.

*Specific simulation structure.* One respondent advised keeping simulation short, not complex, and try to create as much fidelity in the experience as possible. Several of the



respondents stated that you should not skip the debriefing; it was the most important part of the simulation experience for the students. “Debriefing is a sophisticated skill that requires practice and feedback – do NOT short faculty investment in development of this skill”. There should be a dedicated space for the simulation and the debriefing should be conducted in another area so that students can differentiate the two different activities.

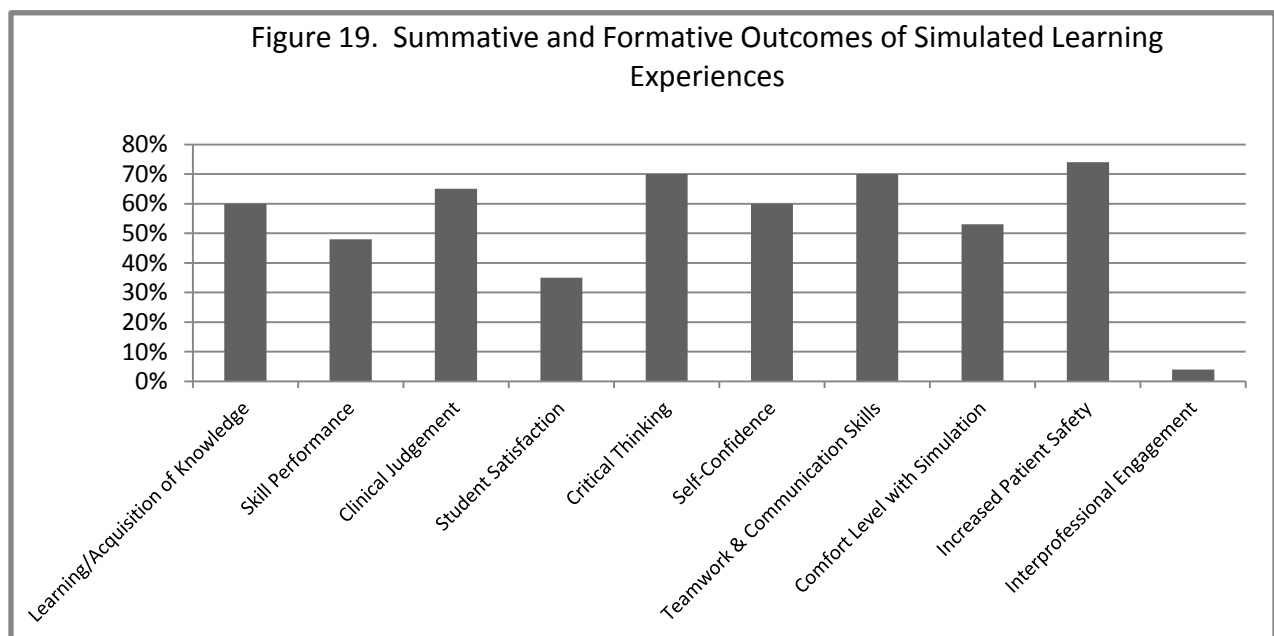
*Research question three summary.* Respondent responses to question three, “lessons learned”, were grouped within four broad categories: faculty engagement; simulation implementation, simulation support and specific simulation structure. While faculty use of the simulator is crucial to initiating curricular use of simulation, keeping faculty engaged had been difficult for many of the nursing programs. Respondents reported that student satisfaction with simulation, student expectations that simulations would be used within courses, and administrative expectations helped keep faculty engaged.

Respondents reported that when implementing simulation programs should go slow, starting with one course and building on that until you have implemented within each course. They also reported that despite feelings of anxiety with the technology just do it – it won’t get easier by putting it off. If the program can afford a support person to program and run the simulation, faculty will not only find the simulator easier to use, but they will be able to concentrate on the educational aspects of the simulated learning experience.

The two most important parts to running the simulation are fidelity and debriefing. The majority agreed that you should have the simulations be as life-like as possible. The majority of respondents reported that debriefing was the most important part of the simulation, with several commenting that you should not skip debriefing. It was thought that this is where the students

could verbally reflect on the simulation and put meaning to what they had experienced. Debriefing was thought to be a highly developed skill in which faculty needed training.

**Research Question 4: What methods are nursing programs using to evaluate (both formative and summative) the use of simulation technology?** Nursing Programs using simulation technology used both formative and summative evaluation strategies to evaluate the outcomes of simulation. Eleven (48%) of the respondents reported that they were currently evaluating simulation experiences. Respondents stated that this was the most difficult part of simulation as there are not standards with which to evaluate simulations. There were several formative and summative outcomes they hoped to achieve: learning and acquisition of knowledge; skill performance; clinical judgment; critical thinking; self-confidence; teamwork and communication skills; comfort level with simulation; increased patient safety; and interprofessional engagement (Figure 19).



*Formative evaluation of simulation experience.* Formative evaluations of the simulated learning experience were the evaluation of those activities that take place during and after the

actual learning experience. The respondents all structured the simulated learning experiences whether through the use of pre-packaged or institutionally developed scenarios. Respondents recognized the need to be flexible during the experience due to the uncertainty of what would exactly occur. Debriefing was identified as the “place where the real learning took place”. Thirteen (56%) of the respondents reported that debriefing was included in every simulated learning experiences.

Another form of formative evaluation is in the area of skill acquisition. Eight (35%) of the respondents reported that they used simulations to assess baseline skills. Twelve (53%) of the respondents reported that students demonstrated skills on high-fidelity simulators prior to patient contact. Students were also gaining new skills in several courses: Assessment 9/39%; OB/GYN 12/53%; Psychiatric 6/26%; Critical Care 9/39%; Pharmacology 2/9%; Ethics 1/4%; and Capstone 5/22% (Table 4).

The respondents did not describe the measures used to determine the acquisition of clinical judgment, critical thinking or increases in student self-confidence. These are outcomes that occur directly through the simulated learning experience. One (4%) respondent reported that they were asking about increased self-confidence on the student satisfaction survey. They reported increased levels of self-confidence through description – not quantitatively.

Learning to function in a team is another formative outcome of simulation which was achieved by placing students in teams for the simulated learning experiences. Thirteen (56%) of the respondents reported they placed their students into teams for the simulation. This was done in a variety of ways. Students also experienced a variety of roles within the simulation as ten (43%) of the respondents who used teams also assigned roles for the students. Tied to acquisition

of team skills was communication, but the respondents did not address how this was being measured.

Interprofessional engagement was reported as a goal of outcome measurement. This could have been formatively measured in a variety of methods. Through the assignment of roles, having the students phone a physician for orders, or by having students from other health professions participate in the simulation. Three (14%) of the respondents reported that their simulations include other health professions during the simulated learning experience. Having nursing students or faculty role play the allied health professional role was not described in the data.

*Summative evaluation of simulation experience.* Summative evaluations are those tangible outcomes that can be measured directly at the end of a learning activity. There were several summative evaluation processes reported. All of the respondents (11/ 48%) who evaluated simulation use used student satisfaction as their largest outcome measure. They measured this through a student evaluation process or survey. Students reported positive comments regarding simulation use. The respondents reported that they made changes in simulation structure, content and difficulty based on student comments from post-simulation surveys.

Learning and skill acquisition was a measured outcome reported by fourteen (60%) of the respondents. Only one respondent reported that their nursing program was measuring this outcome directly through the use of two types of cases. Another respondent reported that they were measuring student performance during the simulation, but performance specifics were not reported. Another respondent reported that they were using test scores and clinical performance

to evaluate learning that occurred during the simulated learning experience. One respondent reported that they were using student evaluations, while another reported they were using course and instructor evaluations. One respondent reported that they were using a written reflection of each experiences, and that overall they were seeing an “overall improved performance and comfort among students”.

*Research question four summary.* Findings for question four centered on how nursing programs who are using simulation were evaluating the simulations formatively and summatively. Respondents (48%) reported that their programs evaluated their simulated learning experiences using their human patient simulators. The major categories of evaluation of simulated experiences were learning and acquisition of knowledge, skill performance, clinical judgment, critical thinking, self-confidents, team work and communication skills, comfort level with simulation, increased patient safety, and interprofessional engagement. There were multiple examples of formative and summative evaluation given by respondents. Formative evaluation included topics such as debriefing and reflective learning activities, assessment of baseline skills, increased self-confidence, teamwork, and interprofessional engagement. Summative evaluation included such topics as student satisfaction, learning and skill acquisition in the form of formal testing. Students value the evaluation feedback they receive during and immediately following the simulation.

**Research Question 5: What are the outcomes nursing programs have experienced since the implementation of simulation technology?** Nursing programs ultimately measure their outcomes through state board pass scores. These measure nursing education success. Fifteen (65%) of the respondents reported board pass rates for the baccalaureate of nursing degree. Three respondents (14%) had scores less than 80%. Three had board pass rates between

80% and 89%. Seven (28 %) reported board pass scores greater than 90%. Two (9%) reported that they didn't have access to this information.

Outcomes from simulated learning experience were measured generally in several ways. Five (22%) of the respondents reported that they were using high-fidelity human patient simulators to evaluate program outcomes. It was not specified as to what outcomes they were measuring or how they were measuring these outcomes. Seven (30%) of the respondents reported that they were using high-fidelity human simulators to evaluate clinical objectives. Again, it was not specified as to how this evaluation was being completed.

*Research question five summary.* While the majority (42%) had board scores greater than 80%. There was no reported correlation between simulation use and board pass scores. Respondents did not report specifics on how they were measuring their outcomes, but that they were using simulation to evaluate clinical outcomes (30%) and program outcomes (22%).

## **Conclusion**

The results from the USTI survey demonstrated very positive responses to the adoption, implementation, and use of simulation. The lack of outcomes measures demonstrates the need for expansion in this area. The discussion of the results and future recommendations follow in Chapter 5.

## **Chapter V: Discussion**

### **Introduction**

This study investigated use of simulation within nursing programs leading to associate or bachelor degrees of science in nursing. Framed by the Structure Process Outcomes Model, a survey was developed and piloted. The survey was then revised and used to obtain data on the current state of simulation use. Seventy-six programs of nursing were invited to participate in three mid-western states. Twenty-three programs of nursing (30% of the sample pool) completed 90% of the survey, with their results reported in Chapter 4. The respondents were viewed as experts within their nursing program. The study reported on the structures and processes that support simulation implementation and use, what had been experienced by the programs since implementation, and the outcomes being measured by the programs.

The significance of this study arises from the necessity to understand how simulation technology is being used in nursing education so best practices can be established. Simulation has been used in nursing education for the past several decades through the use of case studies, standardized patients, and problem based learning (Jones, et. al., 1997; Peteani, 2004). The need for simulation technology has arisen because of the changing nature of the healthcare system and nursing education (Finkelman & Kenner, 2009; IOM, 2003).

The healthcare system is being pushed by a call for increased quality and safety in patient care (Benner, Sutphen, Leonard, & Day, 2010; Finkelman & Kenner, 2009). This is occurring at a time when the system is attempting to prepare for one of the largest shortages of nurses (AACN, 2007). These problems within healthcare have been directly linked to the disconnect between nursing education and nursing practice, thus mandating changes in how nurses are

educated (IOM, 2003; Finkelman & Kenner, 2009; IOM, 2010; Benner, et. Al., 2011).

Simulation technology has been one of the most prominent teaching methodologies used to implement the changes necessary within nursing education and improve the quality of the educational opportunities (Jeffries 2008; Nehring2010a; Finkelman & Kenner; Benner, et. al.).

Simulation technology has improved rapidly over the past 10 years to more closely mimic many human physiological responses (Shinnick, Woo, & Menten, 2011).

The model that was used to guide this study was based on Donabedian's Structure, Process and Outcomes Model and is traditionally used to assess, implement and evaluate quality healthcare programs (Donabedian, 1980; Donabedian 2003; Handler, Issel, & Turncock, 2001; Upenieks & Ablew, 2006). The structure and process used by schools to implement simulation programs lead to successful programs of simulation. The important structural components include the human, physical and financial resources of a program of nursing that supports its academic outcomes. The important processes guide the educational mechanisms leading to the successful accomplishment of the organizational goals and include faculty involvement and training in the use of simulation technology and the specific processes that guide the use of simulation technology. Outcomes are those end results that are deemed important to the program of nursing. Ultimately nursing program outcomes are measured in NCLEX scores. Most nursing programs evaluate learning in multiple ways. Outcomes regarding the use of simulation technology have been measured most commonly as learner satisfaction, self-efficacy, skill attainment, knowledge gains, knowledge transfer, and critical thinking (Shinnick, et. al., 2011).



## Discussion

**Demographics.** The sample demographics had similarities and differences to demographics of nursing programs and nurse educators reported in the literature. The study by Nguyen, et. al. (2011) reported respondent demographics in their survey of nursing faculty and the need for training in the use of new technologies. That study was conducted in the upper Northwest region of the United States, with the majority of the respondents being located in the state of Washington. Other available program statistics are greater than 6 years old. Unlike the study which surveyed nursing programs from the Upper Northwestern states, this study had more nursing programs located rurally. Bachelors of Science of Nursing degrees accounted for the majority of the respondents from all programs, followed by Associate Degrees in Nursing programs, then Masters Degrees in nursing. Years of experience in academia by nursing faculty in the current study was similar to current literature. Another similarity was the academic position held by the respondents in both studies (Table 6).

**Discussion of research question one through five.** The use of high-fidelity simulation technology was reported by 74% of the programs surveyed; with an additional 30% of those not currently using simulation, reporting that they intended to use this simulation technology in the future. This finding highlights the importance of understanding how simulation is being used within nursing programs. The type of simulator purchased, development of the physical space for simulation use, how the simulator will be used, program maintenance and sustainability, and faculty use and training will also be discussed. Evaluation of simulation summatively and formatively for students, program outcomes evaluations and whether or not the goals of the simulation were met will be discussed. Finally, lessons-learned as reported by respondents will give two helpful insights to increasing simulation use.

Table 6:

*Comparison of Sample Demographics with A survey of nursing faculty needs for training in use of new technologies for education and practice.(Nguyen, Zieler, and Nguyen, 2011)*

Demographic	Current Study	Current Literature
Location of Program		
Urban	39%	74%
Rural	57%	26%
Type of Degree Offered by Respondent		
ADN	26%	24%
BSN	70%	50%
MSN	17%	18%
Years of Academic Experience by Respondent		
Median (Range)	6-10 (1 to >25)	10 (1 to 41)
Academic Position by Respondent		
Administrator	14%	7%
Faculty	79%	93%

*Type of simulators.* Simulation technology is expensive from purchasing a high-fidelity mannequin, developing the space, and faculty use of the simulator. Simulators can cost between tens of thousands of dollars to hundreds of thousands of dollars, depending on the level of technology and type of simulator purchased. Since the majority of nursing programs spend approximately \$60,000 on their simulator (Ravert, 2010), programs should spend a considerable

amount of time on the front end planning their program of simulation. Technology differs considerably between the different manufacturers, but having the best technology available does not ensure better simulation outcomes (Gaba, 2004). The majority of the respondents reported that Laerdal® (74%) adult mannequins were the most frequently purchased followed by Gaumard® birthing mannequins (30%). Purchasing these two types of simulators is consistent with the fact that 60% of respondents reported that simulation is used in Medical Surgical Nursing Courses, and 53% reported use within their OB courses.

Funding for the simulator(s) came from a variety of sources, with 70% of respondents reporting the use of institutional money. Many of the respondents had reported that they had attempted to obtain grant money for the simulator but had been unsuccessful. Those respondents who reported that they had obtained a grant for the purchase of the simulator also reported that they did not have sustainable funds for the continuation of the simulation program should the situation arise. It is highly suggested that when programs purchase simulators they also purchase equipment warranties and extended maintenance programs (Ravert, 2010). Those respondents reported that non-sustainability of the simulator had caused stress within the program.

*Physical Space.* Physical space is important to the successful use of simulation (Mayes, 2010; Spunt, 2007). Most respondents agreed with the literature that the physical space should be separate from other laboratory space, with a different space for simulation and debriefing. Most respondents reported that the designed space mimicked a “real” hospital situation. Simulation experts agree that fidelity in the simulation space set the tone for the simulation and helps the students feel that they are in a potentially real situation (Mayes, Spunt).

Most respondents described the processes they went through to plan the space for the simulator. Most respondents reported that their program worked in teams that involved faculty and administration, most had a budget to work with and found it possible to stay within the budget, and most respondents reported that they were ready when the simulator arrived at their facility. Only 14% of the respondents reported that the space was still not ready for use at the time of the survey.

*Basic simulation use.* Basic simulation use was reported as program goals for simulation, implementation of simulation (scenario use running of the simulation and debriefing of the simulation), and the evaluation of the simulation. The majority of the respondents reported that simulation with high-fidelity technology was used in undergraduate clinical courses. Current literature on simulation use discusses the four primary goals of simulation use in undergraduate programs: skill attainment, knowledge gains, knowledge transfers, and increased critical thinking (Nehring, et. al., 2001; Nehring & Lashley, 2004; Nehring 2010b; Shinnick, Woo, Menetes, 2011). The use of simulation for assessment of a student's basic clinical skills was reported by 53% of respondents prior to having students having patient contact. Respondents also reported that they used simulation to teach new skills in health assessment courses (39%); OB (53%), Psychiatric Nursing (26%), and Critical Care (39%). The majority of respondents (60%) reported that learning and acquisition of knowledge was a goal of the simulation program. Increased critical thinking was reported by 70% of the respondents as a goal of their simulation program. Other desired outcomes from the use of simulation were increased levels of student self-confidence (60%) and increased patient safety (72%). Current literature supports increased levels of patient safety as an outcome of simulation (Nehring, 2010b).

There are several issues related to the actual running of the simulation and debriefing. These include scenario use, planning the simulation, fidelity of the simulation, actual running of the simulation, and debriefing of the simulation. Types of scenario depended on the type of simulation being run, the academic level of the student and the experience of the faculty member (Horn & Carter, 2007; Ravert, 2010). The majority of respondents (60%) reported the use of pre-programmed scenarios without modification, while 56% modified the preprogrammed scenarios to meet their educational needs. Development of simulation scenarios is difficult and time consuming for the simulation new-comer (Childs, Sepples, & Chambers, 2007); however 53% reported that they undertook scenario development. For the majority scenario development occurred because their program could not afford to purchase the preprogrammed scenarios. Using a standardized template is supported by experts in simulation (Childs, et. al; Jeffries, 2006). While the majority of the respondents who developed their own scenarios did not use a standardized template, those respondents who reported use of a standardized scenario template, did so to improve the consistency in the student experience.

The respondents reported intense planning for the simulation enabled the students and faculty running the simulation to be prepared. Preplanning for the simulation is very time intensive (Childs, et. al., 2007). The majority of the respondents (65%) designed the simulation experience to be one in which the faculty observe student participation. The majority (56%) used the team approach when running the simulation with (43%) assigning roles prior to the simulation. Roles were assigned one of two ways: rotating responsibility or convenience. Multiple leading professional organizations have recognized the benefits and importance of training students to work in teams (IOM, 2003; AACN, 2008; QSEN, 2011). Increased teamwork and communication skills was a simulation outcome goal in 70% of the nursing

programs. In many programs creating actual interdisciplinary teams are not practical, however training students to work in teams can result in increased ability to work together, to delegate, prioritize, and manage conflict. Simulation has been found to increase critical thinking, reasoning, and judgment, as well as to improve first job success (Finkelman & Kenner, 2009). Common roles assigned to students were the primary or secondary nurses, medication nurses, procedure nurse, charge nurse, family member, doctor, recorder and observer. All of the roles have been well documented in the literature, with the caveat that a description of the role is given to the students prior to implementing the simulation (Horn & Carter, 2007; Nehring 2010b).

The simulated learning experience will vary in length of time required to run a scenario based on the purpose of the simulation, and the time allowed for debriefing should be up to twice the amount of time the simulation takes (Johnson-Russell & Bailey, 2010). The duration of the simulations were reported to be between 15 minutes to 4 hours, with debriefings lasting from 30 to 60 minutes.

The majority of the respondents (56%) reported that their faculty used debriefing. Debriefing took place in a different space from where the simulation occurred. Experts in debriefing agree that a separation between what happens in the simulation and the discussion that follows in order for students to objectively participate in reflection (Fanning & Gaba, 2007). Multiple respondents commented that debriefing should not be skipped because of debriefing's time consuming nature; it was the most important part of the experience for students. Respondents reported a variety of methods to facilitate debriefing. Currently, there are over 10 models for debriefing reported in the literature (Thompson, 2008).

While methods of debriefing vary greatly, it is recognized as one of the most important parts of the simulated learning experiences (Johnson-Russell & Bailey, 2010). The goals of debriefing were reported by the respondents to varying degrees: acknowledging and let go of emotions, strengthening simulation objectives through reinforcement, simplifying the results of the simulation by illuminating the meaning of what occurred, augmenting critical thinking and developing increased problem solving, promoting reflective learning, and finally connecting the simulation to real life events.

Simulation experts believe that a curricular map should be developed to determine in which courses the simulator will be used and whether the time for the simulation will come from didactic or clinical time (Horn & Carter, 2007; Ravert, 2010). Respondents reported that using simulation as a replacement for clinical hours was controversial and had led to multiple disagreements between faculty. The majority of respondents (39%) reported not using simulation as a replacement for clinical hours, while 30% reported that their program did substitute simulation for clinical in areas where they had limited to no access for clinical experiences in critical clinical areas. The majority of respondents reported that one to two days of clinical were being substituted with a simulated learning experience, at a one to one substitution ratio.

*Faculty use.* Respondents reported the key to simulation technology use was faculty. Respondents reported great frustration from the lack of use of the simulators by faculty. They found that many times faculty would agree to use simulation, but in actuality would never get around to using the simulators. Faculty acceptance and use of simulation technology was complex and often multi-factorial. The biggest issues surrounding faculty use were found to be ease of use, incentives and barriers for use, simulation training, and support for the use of the technology, which is consistent with current literature (King, et. al., 2008).

The majority of the respondents (70%) reported that faculty found the simulators easy to use, but the largest barriers to use were faculty time and workload. Respondents reported that faculty resisted use based on not having enough time, resistance to change, or a lack of confidence in simulation. Faculty time and workload issues, as well as resistance to change have been reported frequently in simulation literature (Nerhring, et. al., 2001; Medley & Horne, 2005; King, et. al.). The majority agreed that the largest incentives for use were workload release time for simulation, increased levels of skill, and knowledge regarding the use of a new technology and teaching methodology.

Faculty training and experience for use of the simulation was reported as one of the most important factors to increasing use of the simulator. While 30% of the respondents reported that they had someone on staff that had prior simulation experience 40% reported that they had 1-2 faculty they would consider simulation experts. Respondents reported that training and consistent use were the key to maintaining skill and ease of use. Nguyen, et. al. (2011) found that training in the use of certain technology should be a priority of the nursing program. Training is obtained in multiple ways, including going to conferences and webinars. Several respondents reported learning from one expert on staff – or what is referred to in the simulation literature as the “simulation champion” (Ravert, 2010). Sharing ideas, literature, and training was reported by the respondents in order to increase familiarity with different aspects of simulation.

*Evaluating simulation outcomes.* Experts agree that a well-developed plan of evaluation for the simulation program should occur prior to running the first simulation. This ensures that the simulations have met their desired educational outcomes as well as overall program goals (Jeffries & Rogers, 2007; Jeffries & McNelis, 2010). Respondents reported that they were using simulation to evaluate program outcomes (22%), and clinical outcomes (30%). They did not



specify what tools they were using for evaluation processes, or what their results were from the evaluation process.

*“Lessons learned”*. Keeping faculty engaged once they begin to use simulation can be challenging. Respondents reported that the greatest motivator for keeping faculty engaged in simulation were the benefits for students. Student satisfaction and evaluation of simulation has been reported to be one of the largest motivators to increase faculty simulation use by respondents. Students have been reported to feel very positive regarding simulated learning experiences (Bearson & Wilker, 2005; Bremner, et. al., 2006; Jeffries, 2007). The second greatest motivator for simulation use was administrative expectations. Multiple respondents reported that having administration set the expectation for use prior to obtaining the simulator helps motivate faculty to use the simulation.

Academic and technical support have been found to increase acceptance and use of a new technology (Nguyen, et. al., 2011). Less than half (48%) reported having one person in charge of their simulation program. Respondents overwhelmingly agreed that programs should have at least one part-time person in charge of the simulation program. Respondents also reported that it was important to have a technical person on staff to support the use of simulation as well as to run the simulator. Respondents reported that having a technical person decreased faculty stress and allowed them to focus on the educational aspects of simulation.

**Implications for nursing education.** Nursing education is in crisis. Benner, et. al. (2010) state “The practice-education gap, already untenable, will continuously widen unless nursing education overhauls its approach to nursing science, natural and social sciences, and humanities” (p. 4). Nursing education is facing record shortages of faculty (AACN, 2011; NLN, 2010), a

shortage or lack of availability of clinical placement sites (AACN, 2007; Benner, et al.; NLN, 2010), and a financial crisis. Benner and colleagues report that “federal funding [for nursing programs] is unreliable at best, and probably unlikely” (p. 6). Regardless of the problems within nursing education, society expects highly trained, competent nurses who are able to work within a complex and ever changing healthcare system (Fraser & Greenhalgh; 2001; IOM, 2003; Benner, et al.). At a time when the healthcare is moving towards increased quality and safety outcomes, nursing education is struggling to keep up.

The use of high-fidelity simulation as a teaching methodology has been found to have implications to help with the issues within nursing education. There are multiple guides to designing programs of simulation, designing simulation scenarios, implanting simulation and evaluating simulation (Jeffries, 2007; Nehring & Lashley, 2010). This study demonstrates that simulation is currently being used or is being planned to be used by a majority of nursing programs that participated in this research. This study also adds to what is known by highlighting the current state of simulation within nursing programs. Understanding how simulation has been used will help nursing programs develop plans for simulation use in order to establish best practices within nursing programs. This study’s findings will benefit faculty, program administrators, and accrediting bodies understand the current state of simulation, in order to help establish and run programs of simulation.

**Implications for nursing research.** The greater part of the study findings are supported within the current simulation literature. However the study reveals prevalent gaps in knowledge regarding simulation use as an educational methodology. These gaps include: disadvantages of using simulation technology; funding of programs of simulation; and a clear understanding of

simulation outcomes and methods used to assess simulation outcomes. These gaps need further review and study.

One of the biggest disadvantages reported in current literature occurs when programs attempt to substitute simulation for a majority of their clinical experiences. While respondents did not refer to the substitution of clinical with simulation as a disadvantage they did agree that it had caused a large amount of stress within their programs. The stress was a result of disagreement among faculty as to whether or not to substitute simulation for clinical and at what ratio. Current researchers warned that using simulation in place of key clinical experiences can result in students who don't understand the importance of human touch and actual human interaction. Regardless of the level of simulation fidelity, the simulation cannot fully mimic human to human interaction; or human reaction to stress and illness (Shemanko & Jones, 2008; Benner, et. al., 2010).

Nehring (2008) surveyed U.S. State Boards of Nursing regarding regulation of simulation use for clinical time. State Boards of Nursing typically set clinical expectations within a state, and to date these are not consistent or evidence-based within the U.S. and territories. Nehring reported that five states have made changes with regard to the percentage of time that can be spent using simulation, with one state limiting the amount of time to 10%. The question of substitution of simulation hours for clinical hours was found to be fairly nonspecific. Most states require that program objectives be met, but do not specify how nursing programs meet clinical requirements. Some states require that certain percentages of clinical practice be completed within an actual clinical setting. Finally, approximately one-third of the states reported that they would or were considering stipulating how simulation technology can be used as a substitution

for clinical hours. Studies like this help inform accrediting bodies set regulation and make suggestions for nursing programs regarding important new teaching methodologies.

High-fidelity simulators are expensive. Multiple respondents reported that obtaining a simulator was a financial burden, and that they had difficulty obtaining an adequate amount of money to purchase and maintain a simulator, not to mention the costs of running the simulation. Several respondents knew that the more simulations they ran costs increased proportionately. Most experts agree that you don't need an expensive simulator to use simulated learning experiences. Horn and Carter (2007) remind us that greater amounts of technology in a simulation do not equate to better student outcomes. The use of technology as a teaching methodology should match the technological ability of educator and the academic maturity of the student (Horn & Carter). The literature describes how to run simulation without a high-fidelity simulator, and with different levels of students (Curtin & Dupuis, 2008; Schiavenato, 2008).

The largest knowledge gap identified in this study was in the evaluation of the use of simulation. Evaluating outcomes, regardless of whether they are course, clinical or program outcomes require careful consideration. While respondents reported they used simulations to evaluate clinical (30%) or program (22%) outcomes, they were less specific on how they did this. Several of the respondents reported that they were working on their program of evaluation, but did not have it in place yet. Jeffries and Rogers (2007) describe how to plan for evaluation based on the purpose and goals of the simulated learning experience. Current literature urges evaluation of this new methodology, but few tools exist to assist the educator. Jeffries (2005) has designed two evaluation instruments for the use of simulation the "Simulation Design Scale" and the "Educational Practices in Simulation Scale". The "Simulation Design Scale" can be used to measure the quality of the simulated learning experience across five concepts:

Objectives/Information; Problem-Solving/Complexity; Fidelity; Student Support; and Guided Reflection/Debriefing. The “Educational Practices in Simulation Scale” measures student’s perceptions of the simulation across four concepts: Active Learning; Diverse Ways of Learning; High Expectations; and Collaboration. The use of these tools was reported by two of the respondents.

**Implications for Best Practices.** This study provided two implications for best practices. The results described that approximately 40% of the programs were not ready for the arrival of the simulation technology, and that for the majority of programs there was a considerable gap between the arrival of the simulation technology and use of the simulation technology. Respondents suggested that programs should have strong plans for use developed prior to the simulation technology arrival. Several respondents reported that their curricular plan included simulation use, and that had resulted in increased use of the simulation technology.

Training was found to improve the use of simulation technology. The creation of super users and simulation experts has been found to improve faculty acceptance of simulation technology (Nguyen, et. al., 2011). The respondents reported that often they used each other to support their use of simulation technology and that many of their faculty had done literature reviews, used other forms of simulation within the classroom, or had expertise in simulation use.

**Strengths and limitations of the research.** Strengths and limitations exist in all research studies. This study is no different, although there may be more strengths than limitations. Several of the strengths and limitations are similar and include the sample pool and geographic location. Additional strengths include design type and that only one other similar study has been completed.

The sample pool for this study was 76 nursing programs, creating both strengths and limitations. There were 25 surveys attempted with a 90% completion rate in 23 of the surveys. The 30% response rate for this survey is considered a good response (Dillman, 2007). A 90% completion by respondents to email survey research is considered adequate (Dillman, 2007). All efforts were taken to increase response rates among those surveyed. Respondents were contacted initially and asked to fill out the survey. They were then reminded initially at two week intervals, and then again at one month. Some of the reasons for a lack of response or incomplete surveys could include the length of the survey, the sensitive nature of some of the questions (Dillman, 2007). Other reasons for poor response rates could have been the time of year. Late fall to early spring for educators are very busy times of the year, with several large breaks (Thanksgiving, Christmas, New Years, and Spring Break). Additionally conflicts of interest by the respondents could have influenced respondents to not answer certain questions (Dillman, 2007). Additionally, in an attempt to maintain the anonymity of their responses, respondents may not have answered certain sensitive questions.

Geographic proximity for this study is both a strength and limitation. The three states were in close geographic proximity. Respondents to the survey clustered with majorities answering similarly on multiple questions, including the fact that they were using simulation technology within their nursing programs. This consensus allows the researcher to obtain and share a deeper level of understanding of the simulation experiences within Midwestern nursing programs. However, this geographic proximity limits the generalizability of the findings outside of the Midwest setting. Another limitation is that upon examination of the sample pool the majority of the schools resided in one of the three states. Due to the anonymous nature of the responses it is impossible to know what if any effect that had on the responses.

Definite strengths of the study were the study design and the fact that only one other study had been completed similar to this study. By their nature, descriptive studies allow for the collection of detailed information from a group of people regarding the history, behaviors, knowledge, or thought and preferences of some specific topic. Descriptive studies collect very specific quantitative information, and very descriptive qualitative data. This allows for the information to be used for multiple purposes. This study collected detailed information regarding simulation use within nursing programs within the Midwest. The results of this study will provide understanding in how simulation and simulation technology is being used in nursing education. This research could encourage faculty to become more involved with simulation and program administrators to ease faculty workloads in order to use this innovative technology. Furthermore accrediting bodies can help nursing programs explore best educational practices to achieve optimal outcomes. The nursing associations (NLN, AACN, State Boards of Nursing) associated with the accrediting bodies (NLNAC, CCNE, NCSBN) are funding research in simulation and looking at best ways to help nursing administrators and faculty make the best use of this technology. Results of some of the first studies will be available soon.

On review of the literature, only one article similar to this research was discovered which demonstrates the necessity of this type of research. Nehring and Lashley (2004) surveyed thirty-four nursing programs and six simulation centers regarding simulation use. Simulation was primarily used with nursing students in this study. The programs who were surveyed had purchased Meti® from 1999 to 2002. There are several comparisons allowing for the examination of commonalities and differences between the 2004 study and this study (Table 7). Both studies reported that faculty use was less than optimal. Incentives to increase use were similar in both studies including increased pay, workload release, and personal satisfaction in acquiring new

skills and knowledge related to the new technology. Faculty conducting research was similar with the current study reporting 26% and the 2004 study reporting 21.4%. The similarities and differences between the studies demonstrate the strength of this study. The previous study was completed 8 years ago, so current understanding is necessary to continue to grow the field. The previous study was limited in nature by type of simulation technology owned by the programs and questions asked.

Finally, the last strength of this study was the methodology used to complete the entire study. The survey was developed based in the current literature as described in Chapter 2. It was then piloted in a single Midwestern state similar to the ones surveyed in the actual study. The sample was a group of nursing program in the process of implementing simulation technology through their curricula. The survey was then sent to three simulation experts who rated the items according their ability to measure what they were designed to measure as well as their consistency with the study framework. The total Item CVI for the USTI was .97. This provides support that the scale measures those concepts it was designed to use. This second implementation of the survey has demonstrated some changes that need to be made to the new survey. Several of the questions need to be eliminated related to redundancy, or reworded to simplify their meaning. Additionally, two of the introductory structure questions are more demographic in nature and need to be moved into the demographic section. These simple changes will continue to improve the survey and may improve return rates for other geographic areas in the United States.



Table 7.

*Comparison of Simulation Use Between Current Study and U.S. Boards of Nursing and the use of high-fidelity patient simulators in nursing education (Nehring, 2008).*

Simulation Use	Current Study	Current Literature
Type of Degree Offered by Respondent		
ADN	26%	18%
BSN	70%	78%
MSN	17%	36%
Courses Using Simulation		
Basic Nursing Skills	53%	55.9%
Physical Assessment	39%	58.8%
Medical-Surgical Nursing	60%	63.6%
Pharmacology	9%	57/1%

## Conclusion

Nursing schools that have implemented simulation technology have found it expensive, and at times confusing if not difficult to use. It has been suggested that more research as to the limits and opportunities of simulation, as well as outcomes needs to be completed so that best practices can be established (Seropian et al, 2004; Jeffries, 2008;). Currently one study exists that examines simulation use by healthcare programs and simulation centers that purchased Meti® high-fidelity human patient simulators (Nehring, et. al., 2001; Nehring & Lashley, 2004). The current study adds evidence of current simulation use. It describes actual use by nursing programs and gives lessons learned from through trial and error implementation. The greatest

benefit of this study is that it highlights areas for further study related to simulation use including disadvantages of simulation technology use and evaluation of simulation outcomes.

This study highlights three main issues within nursing programs using simulation. First, funding is and will remain a problem for programs hoping to purchase high-fidelity simulators. Grants, collaborative funding programs between nursing programs and health care facilities, and the allocation of internal funds should be explored as potential solutions. Experienced and successful programs of simulation should partner with those programs struggling to obtain a simulator to help them explore creative funding possibilities. Additionally, creative alternatives to the use of costly high-fidelity simulators exist and should be explored until funds can be obtained. The creative alternatives include using a faculty or students as the patient, using task trainers, or using standardized patients (Curtin & Dupuis, 2008; Stanley & Thompson, 2008).

The second issue surrounding simulation use with nursing practice is the lack of research regarding simulation use. Research regarding simulation technology use, implementation and evaluation, as well as faculty and student perceptions, problems and experiences needs to be undertaken. Tools to adequately gather the data on the topics of simulation use need to be developed, and shared among researchers so that consistency and depth of research findings can be validated.

Finally, researchers and faculty within nursing programs using simulation need to develop strong evaluation plans. Evaluation of simulation experiences is perhaps the most discussed knowledge gap within current literature. Evaluation of simulation use focuses on the summative and formative simulation outcomes as well as curricular outcomes. Common

outcomes listed in the current literature are similar to those in this current study (skill attainment, knowledge gains and transfers, critical thinking, self-efficacy, and student satisfaction).

Several studies have examined skill attainment (Aliner et al., 2006); knowledge gains (Jeffries & Rizzolo, 2006; Kardong-Edgren, Lungstrom, & Bendel, 2009; Ravert, 2008); knowledge transfer (Feingold et al, 2004), and critical thinking (Bruce, Bridges & Holcomb, 2003; Medley & Horne, 2005; Ravert 2008) showing no significant differences between the simulation groups and the control group. Several excellent studies have demonstrated strong outcomes in student self-efficacy (Brown & Chronister, 2009; Sinclair & Ferguson, 2009) and student satisfaction with simulation (Feingold et al, 2004; Henneman & Cunningham, 2005; Jeffries & Rizzolo, 2006; Kardong-Edgren et al, 2009; Ravert, 2008). While nursing educational research has not demonstrated an advantage to the use of simulation, Issenberg, McGaghie, Petrusa, Gordon, and Scalese (2005) showed a weak improvement in learning from the use of simulation. More tools for the consistent evaluation of this technology needs to be developed and tested. The tools that measure gains from simulation are different than previously developed educational evaluation tools. They are tools to measure learning from new educational methodologies.

Simulation as an educational methodology has the potential to change how we educate students. Simulation technology aids the simulated learning environment in multiple ways. The lessons learned are that we need to consider new ways to measure outcomes, increased collaboration between academia and industry to improve affordability and research, as well as support for faculty wishing to use simulation.

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## Appendix 1 USTI Survey

### Use of Simulation Technology Inventory

Student Investigator: Teri L. Thompson, RN, PhD (c), CPNP

Dissertation Committee: Dr. Karen Wambach, Dr. Wanda Bonnel, Dr. Judith Warren, Dr. Bruce Frey, and Dr. Helen Connors of the University of Kansas School of Nursing.

Title: Use of Simulation Technology in Nursing Programs

*Thank you* for taking time to complete this inventory. The inventory should take you approximately 45-60 minutes to complete. All responses will remain confidential.

Your replies will remain confidential and you may choose not to answer any question by simply leaving it blank. There are no questions related to your identify or organizations associated with you.

Completing this inventory that includes a series of check boxes and open ended questions indicates your consent to participate. The Human Subjects Committee at the University of Kansas Medical Center has approved the study.

If you are interested in receiving a copy of the summarized results, there will be an opportunity at the end of the survey to submit your name and email address indicating your interest to [tthompson@kumc.edu](mailto:tthompson@kumc.edu). Again, all results will remain confidential – your name and your school will not be linked in any way with the survey results.

If you have any questions or concerns regarding this research please contact Teri Thompson at 816-213-9888 ([tthompson@kumc.edu](mailto:tthompson@kumc.edu)). You may also contact the dissertation Chair, Dr. Karen Wambach at 913-588-1639.

### Use of Simulation Technology Inventory

#### Definitions for Simulation Technology Inventory Survey

**Structure:** Structure is defined as the stable characteristics of an academic program that can be used to describe the structure of the school and the simulation program. The structure is the objective and measurable human, physical and financial resources that comprise the academic program. Structure includes the numbers of employed professionals, their training, qualifications, and where they are located. Structure also relays the physical size of the institution: the number of buildings, the equipment they possess, geographic location, and proximity to other collaborating institutions. The structure includes the financial resources that an academic program has available for educational courses, technological equipment, physical environments, and further training employed professionals not only as educational specialist, but also as technological specialist (Upenieks & Ablew, 2006; Donabedian, 1980).

Process: The processes of the academic program are those things that convey how the institution is organized to accomplish its work. The governance structure in an academic program leads to the processes that produce good outcomes. They determine the accessibility, continuity and delivery of research and education (Upenieks & Ablew, 2006; Donabedian, 1980).

Output: The ways the program measures success and can be considered as a measure of the effectiveness and efficiency of the academic program. In Nursing Programs outcomes could be directly measured through student state board pass rates. Indirect outcomes would successful interaction of your students in the practice community, successful accreditation by accrediting bodies, as well as post hire reports of high satisfaction with graduates. Nursing programs constantly assess the quality of student learning (Upenieks & Ablew, 2006; Donabedian, 1980).

### Use of Simulation Technology Inventory

#### Questions related to Demographics

Please answer the following questions to the best of your ability. If the question does not apply to your academic institution, just indicate DNA (Does Not Apply).

1. My position at the institution (please choose all that apply)

- ☐ Administration
- ☐ Faculty
- ☐ Staff
- ☐ DNA (Does not Apply)

2. How long have you been an educator?

- ☐ Less than 1 year
- ☐ 1 - 5 years
- ☐ 6 - 10 years
- ☐ 11 - 15 years
- ☐ 16 - 20 years
- ☐ 21 years or more
- ☐ DNA

3. What type of pre-licensure (Pre-RN) Nursing Program do you have? (mark all that apply)  
[You must mark at least 1 response before you can proceed with survey]



- ☐ PN
- ☐ ADN
- ☐ BSN
- ☐ MSN
- ☐ Public
- ☐ Private
- ☐ DNA

4. On average, how many nursing students are admitted per year to your institution?

Admissions per year:

5. Your school of nursing has technical support to assist with simulation:

☐ Yes ☐ No ☐ DNA

6. What year was your school of nursing established?

Year established:

7. Where is your academic institution located? (please state population) [You must mark a response before you can proceed with survey]

- ☐ Rural, close to an urban area
- ☐ Rural, not close to an urban area
- ☐ Urban
- ☐ DNA

### Use of Simulation Technology Inventory

Please answer the following questions to the best of your ability. If the question does not apply to your academic institution, just indicate DNA (Does Not Apply).

Questions related to Structure

8. Please indicate the status of your current School of Nursing building:

	Yes	No	DNA
--	-----	----	-----

	Yes	No	DNA
Does your School of nursing have its own building?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does your school of nursing have enough space to expand?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. What type of administrator is in charge of your nursing department/nursing school?

- ☐ Dean (Nursing Degree)  
☐ Dean (Non-nursing Degree)  
☐ Chair (Nursing Degree)  
☐ Chair (Non-nursing Degree)  
☐ Other type of Administrator (if so, please specify title)   
☐ DNA

10. What kind of funds support your school of nursing? (check all that apply)

- ☐ Student fees and tuition  
☐ Grant Money  
☐ State Money  
☐ Research Money  
☐ Private Endowments  
☐ Public Endowments  
☐ Anonymous Donor  
☐ Other: (please describe)   
☐ DNA

11. Who determines use of simulation in your school of nursing? (check all that applies)

- ☐ Administration within the school of nursing  
☐ Administration outside the school of nursing  
☐ Faculty within the school of nursing  
☐ Faculty outside the school of nursing  
☐ Other: (please describe)   
☐ DNA

12. Please click the F (faculty), the S (student), the B (both), the DK (don't know) or the DNA (Does Not Apply) button to indicate the types of technology that faculty/students in your program are exposed to:

	Faculty	Student	Both	DK	DNA
Basic computer skills (ability to use MS Word, MS Excel, MS Power Point)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Basic internet and search engine skills (Google, Yahoo)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to use and respond to email	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Basic scholarly library search	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PDA's	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Educational delivery platforms (Web CT, Blackboard, or Angel)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Live educational platforms (Eluminate, Wimba, synchronous chats) Computer-based charting within an electronic health record	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computer-based simulation technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low-fidelity simulation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High-fidelity simulation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. What are the barriers to the use of simulation at your institution (check all that apply)

- ☐ 1 - Financial
- ☐ 2 - Faculty time
- ☐ 3 - Skill and Knowledge
- ☐ 4 - Workload
- ☐ 5 - Other: (please describe)
- ☐ 6 - DNA

14. For question # 13, please rank order, by number (biggest barrier to least barrier)

Biggest barrier to least barrier:

15. What are the incentives to the use of simulation at your institution? (check all that apply and rank order them in box # 7)

- ☐ 1 - Financial
- ☐ 2 - Faculty time
- ☐ 3 - Skill and Knowledge
- ☐ 4 - Workload

- ☐ 5 - Other: (please describe)
- ☐ 6 - DNA
- ☐ 7 - Rank order, by number (most to least)

16. For question # 15, please rank order, by number (biggest incentive to least incentive)  
biggest incentive to least incentive:

17. What is the total number of high-fidelity human patient simulators available for student use: (enter a number in each box, if none, please enter 0)

Adult	<input type="text"/>
Child	<input type="text"/>
Infant	<input type="text"/>
Noelle/OB	<input type="text"/>
Other (please describe)	<input type="text"/>
DNA	<input type="text"/>

18. What is the total number of low-fidelity patient simulators available for student use: (enter a number, if none, please enter 0)

Total number of simulators:

Please specify the types your academic institution has:

19. What Manufacturer(s) of human patient simulators are used in your program: (check all that apply)

- ☐ Laerdal
- ☐ Meti
- ☐ Gaumard
- ☐ Other (please describe)
- ☐ DNA

20. How did you obtain each of your simulators? (check all that apply)

- ☐ Institutional funds
- ☐ Donated funds
- ☐ Grant funds
- ☐ Anonymous donors
- ☐ Other

☐ DNA

21. If your simulators were bought with non-institutional money (i.e., grant money, donations, etc.), is there money to sustain your simulation program?

☐ Yes ☐ No

22. Does your institution have a designated space for your simulator(s)? If yes, please describe it.

23. Was the space ready when your simulator arrived?

☐ Yes

☐ No: (please describe) [\[Go to question 25\]](#)

24. If the space was not ready, is it ready now?

☐ Yes ☐ No

25. Briefly describe the process you went through to develop your simulator space (include who had the main responsibility for its development, how you went about deciding on its development, and how the space was funded).

26. Are your simulators out of the box and totally functional and being used by faculty?

☐ Yes

☐ No (if no, please explain):

27. Please indicate:

	0-3 months	4-6 months	7-9 months	10-12 months	more than a year
How long did it take from the arrival of your simulator(s) until they were functional?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How long did it take from the arrival of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	0-3 months	4-6 months	7-9 months	10-12 months	more than a year
your simulator(s) to run your first simulation?					

28. Did any anyone on your faculty have prior simulation experience?

- ☐ Yes (if yes, please describe):
- ☐ No

29. Does your program utilize? (check all that apply)

- ☐ Pre-programmed high fidelity human patient scenarios
- ☐ Pre-programmed high fidelity human patient scenarios which have been modified to better fit your program needs
- ☐ Faculty developed high fidelity human patient scenarios

30. Does your program utilize a standardized simulation scenario form to develop simulation scenarios?

- ☐ Yes
- ☐ No (if no, what format is used to develop scenarios? )

31. Briefly describe what has kept faculty engaged to continue to use simulation technology?

32. Overall, would your faculty say that the simulators are easy to use?

- ☐ Yes
- ☐ No (if no, briefly describe):

33. Have you had some downtime with your simulators due to needed repairs?

- ☐ Yes ☐ No

34. Briefly describe how you replace scheduled simulations if your simulator needed repair:

## Use of Simulation Technology Inventory

Please answer the following questions to the best of your ability. If the question does not apply to your academic institution, just indicate DNA (Does Not Apply).

#### Questions related to Process

35. What type of governance structure does your school of nursing use: (please describe)

36. What educational pedagogies does your institution use? (i.e., constructivism, experiential learning, adult learning theory, etc.)

37. What are the theories or frameworks that your school uses to support their philosophy, mission, or educational pedagogies?

38. Please click Yes or No to indicate:

	Yes	No
Does your school of nursing support continuing education?	<input type="radio"/>	<input type="radio"/>
Are their currently faculty conducting simulation research?	<input type="radio"/>	<input type="radio"/>
Are you currently evaluating implementation outcomes from your simulation experiences?	<input type="radio"/>	<input type="radio"/>

39. Does your nursing program use high fidelity human patient simulators?

- ☐ Yes
- ☐ No (if no, click button, then you will automatically go to question # 64 to finish the survey)

40. Is there one person who is in charge of your simulation program? (the development, implantation, and evaluation of simulations) [You must mark a response before you can proceed with survey]

- ☐ Yes (if yes, click the yes button. Is this the person's main role at the school of nursing?

Please enter Yes or No in the box for this response.

☐ No

41. If there is not one person in charge of your simulation program? (briefly describe how your simulation program is organized)

42. How many faculty would you describe as having expertise in using high fidelity human patient simulators?

# of Faculty with experience:

43. Are you using simulation in both undergraduate and graduate courses?

☐ Yes ☐ No

44. In which of the following capacities are high fidelity human patient simulators used in your program. (mark all that apply)

☐ Faculty participation and student observation

☐ Student participation and faculty observation

☐ Assessment of baseline skills

☐ Evaluation of program objectives

☐ Evaluation of clinical objectives

☐ Other: (please describe)

45. In which pre-licensure clinical and nonclinical areas will high fidelity human patient simulators be used. (mark all that apply) Please enter the Projected Hours for each Clinical Stimulation Experience in the boxes.

☐ Assessment:

☐ Med/Surg:

☐ Pediatric:

☐ OB/Gyn:

☐ Psych:

☐ Critical Care:

☐ Pharmacology:

☐ Ethics:

☐ Capstone:



☐ Other(s): (please describe)

46. Are simulations being used to replace clinical experiences?

☐ Yes: If yes, click the yes button. How is that being done at your school of nursing? (please describe in the box)

☐ No

47. Briefly describe graduate course in which you use high-fidelity human patient simulators:

48. If you offer a nursing education masters, are you educating those students in the use of simulation?

☐ Yes ☐ No ☐ N/A

49. Are high fidelity human patient simulators used to demonstrate skill prior to patient contact?

☐ Yes ☐ No

50. Do groups of students participate as teams in high fidelity human patient simulation scenarios?

☐ Yes: If yes, click the yes button. What is an average number of students per team? (please enter the average number in the box)

☐ No

51. Do you assign roles to your students who work in teams?

☐ Yes: If yes, click the yes button. (please enter a brief description in the box)

☐ No

52. Are high fidelity human patient simulations captured on videotape?

☐ Yes ☐ No

53. If so, are the videos reviewed with the students?

☐ Yes ☐ No

54. From start to finish, what is the average time per high fidelity human patient simulation experience?

Average time:

55. Does each high fidelity human patient simulation experience include time for student/faculty debriefing?

- ☐ Yes: If yes, click the yes button. (please enter the average debriefing length of time in the box)
- ☐ No

56. Please click Yes or No to indicate:

	Yes	No
Do high fidelity human patient simulations include participants from other allied health professions, i.e., respiratory therapy, emergency medical services, pharmacy, medical students?	<input type="radio"/>	<input type="radio"/>
Do other allied health professions have access to your program's high fidelity human patient simulators?	<input type="radio"/>	<input type="radio"/>

57. How did your program address faculty training in the initial introduction of high fidelity human patient simulators to the nursing program?

58. How does your program address ongoing faculty training or in-service in the use high fidelity human patient simulators?

59. Does your school have any simulator partnerships? (with other schools or hospitals) [You must mark a response before you can proceed with survey]

- ☐ Yes [\[Go to question 60\]](#)
- ☐ No: (If no, you will automatically go to questions # 62)

60. If you answered 'Yes' to question # 59, please enter who houses the simulator:

Who houses the simulator:

61. If you answered 'Yes' to question # 59, please describe the partnership relationship (i.e. who controls the scheduling of the simulator, who pays for maintenance, who orders the supplies for the simulator, etc.

Only answer this question if your SON is *not* currently engaged in simulation use.

62. Do you now or in the near future plan to utilize high fidelity human patient simulators as clinical learning experiences?

- ☐ Yes  
☐ No

63. If yes, for which clinical areas will high fidelity human patient simulators be used? (Mark all that apply) Please enter the Projected Hours for each Clinical Stimulation Experience in the boxes.

- ☐ Med/Surg:   
☐ Pediatric:   
☐ OB/Gyn:   
☐ Psych:   
☐ Critical Care:   
☐ Other(s):

### Use of Simulation Technology Inventory

Please answer the following questions to the best of your ability.

#### Questions related to Output

64. Please indicate board pass scores by applicable degree program: (please enter scores in the adjacent box - if the program doesn't apply, please enter DNA in the box)

- ☐ PN:   
☐ ADN:   
☐ BSN:   
☐ MSN:

65. Are students satisfied with the use of high-fidelity simulation at your school?

- ☐ Yes: If yes, click the Yes button. Please enter a brief description of student's satisfaction in the box   
☐ No: If no, click the No button. Please enter a brief description of student's dissatisfaction in the box.

66. What student outcomes does your program hope to achieve with high fidelity human patient simulation experiences? Mark all that apply.

- ☐ Learning / acquisition of knowledge
- ☐ Skill Performance
- ☐ Clinical Judgment
- ☐ Student satisfaction with simulation experiences
- ☐ Critical thinking
- ☐ Self-Confidence
- ☐ Acquisition of teamwork & communication skills
- ☐ Student comfort level with simulation experiences
- ☐ Increased patient safety
- ☐ Other(s): please comment:

67. How have you measured those outcomes? If so, briefly describe how?

68. Have you used those outcomes to evaluate your simulation program? If so have changes been made to how you use simulation, briefly describe:

69. What are the lessons learned/advice for others regarding the integration of high fidelity human patient simulators for nursing education?

Again, *thank you* very much for completing this survey. I appreciate your time and input. Now, to complete the survey, please press the "Submit Survey" button.

## Appendix 2: Table A1

Table A1

### *Simulation Use Literature*

Table A1: Review of Simulation Use Descriptive and Research Literature					
STUDY & AUTHOR	OBJECTIVE	DESIGN AND INTERVENTIONS	SUBJECTS	OUTCOME MEASURES	OUTCOMES
Alinier, G., Hunt, B., Gordon, R., & Harwood, C. (2006). Effectiveness of intermediate-fidelity simulation training technology in undergraduate nursing education. <i>Journal of Advanced Nursing</i> , 54, 359 – 369.	The purpose was to examine the effect of scenario-based simulation on clinical skills and confidence.	Quasi-experiment with pretest and posttest groups.	Approximately 99 Nursing Students per cohort for a total N = 344	Objective Structured Clinical Examination pre and post test. This 15 stations structured clinical examination that can be used to test clinical skills. No reliability or validity reported.	Students responses on structured clinical exam were significantly improved in the simulation group, perceptions of stress and confidence in performance were similar between the simulation group and the control group.
Bearnson, C.S., & Wilker, K.M. (2005). Human patient simulators: A new face in baccalaureate education at Brigham Young University. <i>Journal of Nursing Education</i> , 44, 421 – 425.	The purpose of this study was to determine the advantages and disadvantage of using HPS as a clinical day substitute. Outcomes of the simulation demonstrated and increase in student knowledge, ability and confidence.	Explorative, Descriptive study	Student groups no N reported.	Survey that was created for the study, consisting of 4 Likert questions , and 3open-ended questions about learning. No reliability or validity.	Student felt positively about the simulated learning experiences, they experienced and increase in knowledge, skills, and confidence.
Brannan, J.D., White, A., & Bezanson, J.L. (2008). Simulator effects on cognitive skills and confidence levels. <i>Journal of Nursing Education</i> , 47, 495-500.	Purpose was to compare the effectiveness of two teaching methods: traditional class room lecture and use of HPS simulation experiences on junior-level cognitive skills and confidence.	Prospective, quasi-experimental, pretest and posttest comparison group was used. The IV was instructional method. The DV's were cognitive skill and confidents	107 baccalaureate nursing students enrolled in junior-level adult health courses.	Acute Myocardial Infarction Questionnaire: Cognitive Skills Test Form A & B. Confidence Level Tool Demographic Form. No reliability or validity reported.	Students who participated in the simulations had significantly higher posttest cognitive skill scores, confidence levels among the two groups did not differ significantly.  This study showed that you can use larger groups for an evolving scenario, and that it is an efficient and effective alternative to traditional teaching methodologies.

<p>Bremner, M.N., Aduddell, K., Bennett, D.N., &amp; VanGeest, H.B.. (2006). The use of human patient simulators: Best practices with novice nursing students. <i>Nurse Educator</i>, 31, 170 – 174.</p>	<p>Purpose of this article is describe quantitatively and qualitatively students reactions to simulations, best practices for simulation use are identified.</p>	<p>Students participated in a simulation experience and filled our questionnaire regarding their experiences.</p>	<p>56 novice nursing students in a baccalaureate program</p>	<p>Two part questionnaire regarding the simulation experiences.</p>	<p>Students experiences: 95% rated experience as good or excellent, and 68% said the experiences should be mandatory. 61% felt increased confidences after, 48% said it relieved stress.</p> <p>Best practice recommendations: “well-articulated learner outcomes for HPS session; clear connection to course/clinical objectives and overall HPS session; established ongoing training and supervision of faculty, staff, and participants; collaboration with student and faculty in planning, implementation and evaluation of each HPS session; debriefing session after each HPS experience” (p. 173).</p>
<p>Childs, J. C. S., S. (2006). Clinical teaching by simulation lessons learned from a complex patient care scenario. <i>Nursing Education Perspectives</i>, 27, 154 - 158.</p>	<p>The purpose of this study was to test the reliability and validity of two instruments: the educational practice scale for simulation, and the simulation design scale. Simulations are an educational method that allows for the transfer of clinical knowledge in a clinical setting. Simulations range from simple to complex, and have the ability to teach clinical skills more quickly. They result in higher levels of critical thinking and learner</p>	<p>Descriptive survey study</p>	<p>N = 55 Students involved in the simulation</p>	<p>After students were exposed to four simulated experiences, they were asked to fill out three instruments. The educational practice scale for simulations is a 16 item instrument that bases scores on a 5 point scale. It was designed to measure four educational practices: active learning, collaboration, diverse ways of learning, and high expectations. The simulation design scales was developed to evaluate five simulation design features: the use of objectives and information,</p>	<p>Results: Students felt that the feedback, learning objectives and shared information were the most important features in the simulation. They appreciated their level of complexity of the simulated experiences, and while they liked the more complex situations better, these simulations also produced the most stress for the students. They rated feedback as the most important educational practice closely followed by collaboration, active learning, high expectation, and diversity in learning situations. The students agreed that overall that simulations provided ideal learning experiences.</p>

	satisfaction.			support, problem solving, feedback and fidelity. It is a 20 item scale, scored on a 5 point scale. Additionally students were asked fill out a survey that rated the usefulness of the simulations, their feeling about simulations as a teaching method, and the amount of self-confidence gained from participation.	Discussion: The group found time allowance for both the simulation and debriefing should be considered. Not feeling rushed is very important. While simulations should be highly structured and planned, they provide a flexible learning environment for students. Faculty and students need to remain open to unexpected learning situations, and that the use of simulations can cause just as much anxiety as caring for real patients. Four students are the ideal number in any simulation, and in larger groups, weaker students are able to disguise their weaknesses. Students should dress and act professionally in the simulation environment.
Dearman, C.N. (2003). Using clinical scenarios in nursing education. In M.H. Oermann & K.T. Heinrich (Eds.), Annual Review of Nursing Education (pp. 341-355). New York, NY: Spring Publishing Company, Inc.	The purpose of this study is to describe clinical simulation and types of scenarios that can be used in simulation.	Descriptive study	No participants	Clinical scenarios are imaginary situations in which a student must holistically care for a client with health care and non-health care related needs. The student must critically think in order to care for the patient and discover all of the real and potential needs, potential and real solutions. They must then present a solution and the critically evaluate it's outcomes, suggesting changes or other alternatives. Clinical scenarios are active cognitive processes, where	There are many different types of clinical scenarios: photographs, video and audiotapes, case studies, and then computerized clinical scenarios, as well as the use of human patient simulators. Clinical simulations allow students to clinically practice different clinical solutions to multi-layered complex scenarios. The student can make mistakes and learn from them in a safe environment, no harm comes to a live person. When students learn from clinical scenarios, they must apply all previously learned knowledge and experience to new situations. This increases their ability

				<p>students can consider different solutions to the clinical problems that are presented, and then evaluate their potential effectiveness. The practice of using clinical scenarios to learn, whether individually or in groups, helps the student learn how to process the information so that they can come up with solutions when they encounter similar clinical situations in the real world, as well as methods of evaluation. Scenarios teach expertise through experience. Scenarios increase a student's self-efficacy, or their ability to place themselves with in a situation, and have the confidence to deal with the situation. This experience is a dynamic process that is life-long evolving dynamic process, changing the novice into the expert.</p>	<p>to deal with new future situations, and make good clinical judgment. Regardless of the type of clinical scenario, utilized debriefing is the final phase. This allows students to reflect and openly discuss what happened during the scenario, how they decided among a list of possible solutions, their cognitive rationale, and how their decisions affected patient outcomes. The students are free to deal with how they felt in caring for the client. These authors apply Chiodo and Flaim's model for debriefing: recall, inference, comparison, generalization. These help guide instructors facilitate a debriefing which further helps student learn from the situation.</p>
<p>Feingold, C.E., Calaluca, M., &amp; Kallen, M.A. (2004). Computerized patient model and simulated clinical experiences: Evaluation with baccalaureate nursing students. <i>Journal of Nursing Education</i>, 43, 156 – 163.</p>	<p>The purpose of this article is was to evaluate student performance and faculty and student perceptions of performance and satisfaction with simulated learning experiences.</p>	<p>Descriptive non-experimental survey study</p>	<p>N = 65 Senior Students and their faculty participants</p>	<p>Two Likert surveys one for faculty one for students</p> <p>The student survey had 20 items that were divided between three subscales: realism, transferability, and value of the experience. Additional items are non-scalable.</p> <p>17 item faculty survey regarding</p>	<p>Students valued the experiences finding it realistic and an sufficient test of clinical skill and decision making; it enhanced learning, increased confidence, improved their clinical confidence, prepared them to function in the real world.</p> <p>Faculty believed that SLE prepared students for real life experiences, that the experiences</p>



				use and satisfaction with simulation	adequately tested skill and , effective teaching method,
Guillaume, A., Hunt, B., Gordon, R., & Harwood, C. (2006). Effectiveness of intermediate-fidelity simulation training technology in undergraduate nursing education. <i>Journal of Advanced Nursing, 54</i> , 359-369.	The purpose of this paper was to determine the use of simulation on clinical skill and competence.	Quasi-experimental pre and posttest design, a survey to determine levels of stress and confidence	N= 67 Students who completed all sessions	Pre-post design, and survey	The experimental group that was exposed to simulation scored significantly better on the second on the post-test after exposure to simulation, there were not significant differences in the students perception of stress or confidence levels.
Henneman, E.A., & Cunningham, H. (2005). Using clinical simulation to teach patient safety in an acute/critical care nursing course. <i>Nurse Educator, 30</i> , 172-177.	To describe the processes and methods used to develop, implement and evaluate simulation experiences.	A frameworks was designed to facilitate the design and implementation of simulation experiences, this was used to evaluate their use. Students were surveyed regarding their perceptions of the experiences.	Faculty developing the simulations, and students participating in the simulations.	Framework as an evaluation tool, student perception survey.	<p>Framework based on Principals guiding the simulation, Simulation development history, Objectives of the simulation, case scenario, programming simulator, props, preparing students, final check and references. Debriefing students consistently.</p> <p>Evaluation of student perceptions: students were satisfied with the experiences, feelings of satisfaction increased with increased comfort and confidence in faculties ability,</p> <p>Lessons learned: Importance of overcoming student anxiety with interacting with simulator, being videotaped or observed,. Introduce students early in the nursing program to simulation through the use of simple simulations,. Allow students the opportunity to repeat simulations where errors could potential</p>

					impact patient safety. Importance of teamwork in developing simulations,
Henneman, E.A., Cunningham, H., Roche, J.P., & Curnin, M.E. (2007). Human patient simulation: Teaching students to provide safe care. <i>Nurse Educator</i> , 32, 212 – 217.	This article describes the experience of the development and implementation of a MVA simulation.	Descriptive study: It simply describes the experience of one school of nursing regarding simulation use.	Describes the students who participated in a simulated learning experience; no specific N.	<p>Student preparation</p> <p>Instructor preparation</p> <p>Simulation roles</p> <p>Supplies and set up</p> <p>Reflective discussion/ Debriefing</p> <p>Patient safety Information</p> <p>Evaluation</p>	<p>Students receive orientation to the simulation experience, educational materials including reading assignments, guidelines on participation, the objectives of the simulation.</p> <p>Participation with their clinical group, Consistent educational simulation with clinical variability</p> <p>Roles for the actors: patient, family, physician etc. well defined and scripted,</p> <p>Scripted list of supplies and props; programming of the simulator, scripts for the actors.</p> <p>Critical component of the learning experience; consistency of this is essential; structured around key events;</p> <p>Key to include in every simulation, so that medical error is reduced, to correct wrong actions and to help students understand the effect of their actions</p> <p>Can be used to formally evaluate, provide feedback to students,</p>
Jarzemsky, P. A. & McGrath, J. (2008). Look before you leap: Lessons learned when introducing clinical simulation.	To determine outcomes in the domains of confidence, ability, stress and critical thinking in beginning-level, baccalaureate	Faculty designed 5 simulations scenarios in which students were expected to perform and critically think about: vital signs, urinary catheterization, intravenous or	85baccalaureate nursing students near the end of their first clinical course. 48 students were in the experimental group participating in	20 item survey designed to measure student's confidence, ability, feelings of stress and critical thinking using a 5 point scale. Cronbach $\alpha$ for the	There was a significantly higher self-rating scores in all areas in the group that participated in the simulation experiences. This supports earlier findings of Curran and

<i>Nurse Educator</i> , 33, 90-95	nursing students before and after participation in structures simulations about urinary caths, IV and nasogastric med administration and sterile dressing changes prior to investment in high fidelity patient simulators.	nasogastric medication administration, or sterile dressing changes. Students self-rated themselves regarding their confidence, ability , stress levels, and critical thinking. These simulations used low-fidelity simulators.	simulation experiences; 37 were in the control group that did not participate in simulation experiences.	scale was .91.	<p>Rhodes: “students gain confidence in their ability and decision making and feel less stressed about performing skills when given the opportunities to practice” (p. 93).</p> <p>Budget should not deter faculty from using simulations as a teaching method.</p> <p>Students were found to prepare for lab more when actually participating in a simulated experience. Leading to the thought that students take a more active role in learning in simulated experiences.</p> <p>Lessons learned:            *focus scenarios on those skills less likely to be frequently encountered            * advantages of simulations: safety, increased practice; learn consequences of actions; capture of “teachable moments”; accountable for practice and ultimately actions; less stress than when in the practice arena;</p>
Jefferies, P.R., & Rizzolo, M.A. (2006). Designing and implementing models for the innovative use of simulation to teach nursing care of ill adults and children: A national, multi-site, multi-method study. <i>National League for Nursing: Summary Report.</i>	This study had four purposes: Development and testing of models faculty can use when implementing simulations; increase the numbers of nursing faculty who use simulation; contribute to the body of knowledge regarding simulation use in nursing education; and demonstrate	Multi-phase multi-method study that used many different tools to evaluate the efficacy of simulations and	395 students	<p>Simulation Design Scale</p> <p>Educational Practices in Simulation Scare</p> <p>Student satisfaction with learning scale</p> <p>Self-confidence in Learning using Simulations Scale</p> <p>Tests of cognitive knowledge</p> <p>Self-perceived Judgment Performance</p>	The group that used simulation vs paper pencil case study found more opportunities to solve problems in their learning experience. They both found that feedback was very important to the learning experience. Students with simulation found that they placed a higher value on the learning activity, they had a higher level of satisfaction with their learning experience, simulated experiences have more best

	business collaboration between academia and business.			Scale.	educational practices. There was no significant difference between the groups on skill performance, there were increased self-confidence in the simulation group,
Johnson, J., Zerwic, J.J., & Theis, S.L. (1999). Clinical simulation laboratory: An adjunct to clinical teaching. <i>Nursing Education</i> , 24(5), 37-41.	To describe simulations used in laboratory. The structure, implementation and evaluation and potential use is discussed.	Descriptive research	Students in the simulation; no specific N given.	These authors developed 13 role-played simulation experiences that they video taped and 8 role-played telephone experiences which were audio taped and then asked students to evaluate their experiences using a Likert scale questionnaire and descriptive questions. Video-taping and audio-taping allowed students review and recall the situation so that they could reflect on what happened during the simulations.	Findings: Students were required to participate in both type of complex patient experiences. These replaced a clinical day for the participants. The students assumed roles within the simulated experiences. After the scenarios the faculty reviewed the tapes with the student group and facilitated a discussion regarding what occurred, how the student felt, and what other possible solutions were available for the situation. The simulations focused on learning not formal evaluation. Students were asked to describe what the felt they did well, and what they would have done differently given the opportunity. Conclusions: The students reported and increased sense of competence, and felt they had the ability to deal with increasingly difficult client situations. They appreciated the application of previously learned concepts, and felt that the simulations relied more on critical thinking versus strict memorization of facts. Overall the students rated the experiences as positive, with mean ratings of 5.39, using a 6 point Likert scale. Three of the 51 students found the

					<p>experiences unbeneficial. The students preferred the telephones simulations to the videotaped simulations, as demonstrated by higher means. The students reported that they felt that the experience provided them with the opportunity to:</p> <p>“thinking on their feet” (m=5.53, sd .91)</p> <p>-“to use critical thinking” (m=5.47, sd .94)</p> <p>“to use focused communication (m=5.39, sd .96)</p> <p>-“to reinforce prior learning” (m=5.39, sd .94)</p> <p>Discussion: Overall simulations provide a positive learning environment in which students are able to reinforce knowledge and apply it to new and varied clinical situation without the fear of making major errors. Students are able to apply previously learned material, and test out new ideas with out the “stress of a real patient”. student’s self-confidence increases, as they were asked to critically critique their performance as well as their peer’s performance.</p>
Kardong-Edgren, S.E., Starkweather, A.R., & Ward, L.D. (2008). The integration of simulation into a clinical foundations of nursing course: Student and faculty perspectives.	This article describes the steps to integrate simulation into a nursing curriculum. The author used current research to design and implement the simulated learning experiences. The	Research: prospective, descriptive repeated measures design	100 nursing students. In three scenarios,	Review of the literature	<p>Reluctance of faculty to adopt simulations is due to time , resources and technical ability. The literature supports the use of active learning strategies to obtain better learning outcomes. Reports that their simulator sat in a box for over a year before used. Simulation should be</p>

<p><i>International Journal of Nursing Education Scholarship</i>, 5(1), Article 26.</p>	<p>author reviews several key points: scenarios based on didactic information; debriefing; and repetitive practice. Results from ran scenarios; with an emphasis on repetitive practice.</p>			<p>Procedure</p> <p>Educational practices</p> <p>Simulations Design</p> <p>Student satisfaction Self-confidence</p> <p>Faculty evaluation</p>	<p>implemented from the beginning of the curriculum, it has been shown that simulations can increase skill and almost twice the knowledge acquisition vs. students who did not use simulations. Reflection is an important part of simulation, allowing the student to appreciate the full content within the simulation.</p> <p>Used Jefferies theoretical framework to design three consecutive scenarios that increased in skill level and application.</p> <p>Students felt hat the best practices in active learning were used in each simulation: active learning, collaboration, high expectations, and diverse ways of learning.</p> <p>Students felt high levels of satisfaction with information, support, problem solving feedback and fidelity.</p> <p>Self-confidence and satisfaction with the simulation did not differ between the three simulations.</p> <p>Creative and interactive teaching and learning in environment Increased time and coordination Repetitive practice helps set skills, cognitive reasoning, and critical thinking. Difficulty to run the scenarios, simulator and take care of the students.</p>
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<p>King, C.J., Moseley, S., Hindenlang, B., &amp; Kuritz, P. (2008) Limited use of the human patient simulator by nurse faculty: An intervention program designed to increase use. <i>International Journal of Nursing Education Scholarship</i>, 5, 1-17.</p>	<p>The purpose of the study was to examine the factors that lead to underuse of human patient simulators by nursing faculty in a program leading to an RN degree.</p> <p>Phase 1: determine the attitudes, subjective norms, perceived behavioral control, and intent to use human patient simulators.</p> <p>Phase 2: was used to understand the effect of an educational intervention on intent to use, attitudes, subjective norms, and perceived behavioral control as well as which factors are most important in explaining intent to use HPS.</p>	<p>Two- phase study with both quantitative and qualitative data was collected.</p> <p>Instruments were designed based on the concepts from the theory of planned behavior: attitudes, subjective norms and perceived behavioral control.</p> <p>Phase 1: investigated the faculty attitudes, subjective norms, perceived behavioral control, and intent to use HPS</p> <p>Phase 2: a pre-and post-survey method was used to evaluate an educational intervention designed to motivate faculty to implement human patient</p>	<p>Phase 1: Approximately 48 faculty members .</p> <p>Phase 2: A convenience sample of 16 faculty members.</p>	<p>Phase 1: The faculty attitudes and Intent to Use Related to the Human Patient Simulator (HPS). Faculty Satisfaction Survey – Use of Sim-Man for Simulated Clinical Experience Nurses’ Attitudes Towards Computerization Open Ended qualitative questions</p> <p>Phase 2: AND Faculty HPS Pre-Educational Program electronic Survey Faculty Post-Educational Program Survey on the HPS.</p>	<p>Phase 1: Attitude items that were less than the desired mean were: fits well into courses taught; comfort using and competent using. Subjective norms: other faculty want me to use; and students want me to use. Perceived behavioral control items less than desired mean: a lot of extra prep time; the amount of time to be proficient in use; HPS is easy to use. 71% of faculty had high intent to use, but only 53% had actually used. 62% had no prior hands on training; 73% had not attended any educational offering on the HPS. Lack of formal training contributed to lack of comfort and competence. Qualitative questions: Use would increase: with more time, support from lab personnel, more education and training Advantages: realistic experience; critical thinking, active learning; safe environment Disadvantages: lack of time, support, education, limited by number of students Education needed: how to operate, how to utilize, printed instructions, hands on training</p> <p>Phase 2: 73% who were trained had no prior formalized HPS training; 67% had used the HPS as a teaching tool. The participants had used HPS 1.9 times during the last year, with 47% using the HPS 0-1 times. Paired t-tests</p>
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					demonstrated significant positive results from the educational intervention. The two perceived behavioral control items with the most positive change were that HPS requires a lot of prep time, and ease of use.
Leigh, G.T. (2008). High-fidelity patient simulation and nursing students' self-efficacy: A review of the literature. <i>International Journal of Nursing Education Scholarship</i> , 5,37.	This descriptive paper describes the literature regarding the use of high-fidelity simulation and student's self-efficacy.	Review of literature? Integrated? Type?	what parameters were used to identify the literature used in the review?	<p>Defining Self-efficacy</p> <p>Effectiveness of High-fidelity simulation</p> <p>Challenges of HPS</p> <p>The Effect of HPS of Self-efficacy</p>	<p>"belief in one's capability to execute the actions required to attain a goal" p. 2. This belief affects self-confidence and performance, learning, and skill ability. Self-efficacy can increase over time as one has new experiences, it has been found to have a profound influence on clinical judgment and decision making. A teaching method that increases self-efficacy has not been determined.</p> <p>Students increase skills and knowledge from experiential learning in a safe, non-threatening environment. Increased levels of critical thinking, leadership, decision making, problem-solving and prioritization abilities after experiential learning. Simulation allows students to learn from mistakes, peers and identify gaps in knowledge.</p> <p>Creating a realistic environment; being put on the spot; fear of being perceived as stupid; increased anxiety; and problems communicating with a mannequin. Faculty perceived simulations took a lot of time, effort, and resources. Costs can be</p>



					<p>prohibitive.</p> <p>Several studies show increased self-confidence/Self-efficacy after participation; especially in skills. Students had a increase in their belief that they could deal with the unexpected. Students had an increase in motivation to study further.</p> <p>Other benefits: decrease in anxiety; control of negative emotions; opportunity to learn through the application of knowledge. Observing other students is just as beneficial, the opportunity for feedback on performance.</p>
<p>Medley, C.F. &amp; Horne, C. (2005). Using simulation technology for undergraduate nursing education. <i>Journal of Nursing Education</i>, 44, 31-34.</p>	<p>The purpose of this article is to describe the state of simulation at the time, advantages, critical thinking, experiential learning, scope of use, processes for instruction, leveling of content, complex realistic situations, faculty resources, and collaboration are a few of the key concepts discussed.</p>	<p>Descriptive that describes how simulation can be implemented and leveled across the curriculum.</p>	<p>No subjects</p>	<p>Experiential learning</p> <p>Advantages</p> <p>Scope of Use</p> <p>Process of Use</p> <p>Leveling content</p> <p>Faculty resources</p>	<p>Students prefer experiential learning experiences; practice and reflective learning are key to clinical learning; current lack of clinical experiences;</p> <p>Advantages include: fidelity; safe environment; active learning environment; can pinpoint certain clinical situations that are rare or hard to get experientially; consistent and comparable experiences for all students.</p> <p>Scope of use: wide variety of simulated learning experiences; variety of educational methods and techniques; Fidelity; feedback and critique of performance;</p> <p>Processes for use: determine content and the learning objectives; fidelity of</p>

				Collaboration	<p>the experience; record the experience; debriefing consistently;</p> <p>Level content across the curriculum, from early use to use in final courses. The experiences can be from simple to very complex. Roles for students: faculty members and students.</p> <p>Time and training on simulation use, scenario development, technical and laboratory assistance,</p> <p>Collaboration across campuses and the nation with other faculty who use simulation on use, research,</p>
Nehring, W.M., Ellis, W.E., & Lashley, F.R. (2001). Human patient simulators in nursing education: An overview. <i>Simulation &amp; Gaming</i> , 32, 194-204.	The purpose of the is article is to describe simulation in nursing education. This article highlights education, research and evaluative applications. Critical Incident Nursing Management (CINM) is discussed as an instructional framework. They briefly discuss administrative concerns such as finances, and use.	Descriptive Study describing the development of a program of simulation.	No Subjects	<p>CINM framework use is described.</p> <p>Educational Uses</p> <p>Advantages and Disadvantages</p> <p>Research Use</p> <p>Simulation Use</p>	<p>Framework that is used to teach nursing care in view of critical health incidences. The outcome by the student is appropriate care based on appropriate knowledge, technical skills, and critical thinking.</p> <p>Educational use: to teach knowledge and skills to all levels of nursing students, allowing them to practice real interventions. Allows the student to reflect on practice through structured and unstructured debriefing and reflection.</p> <p>Advantages include: practice in safe environment; enhancement of learning; increase in self-confidence,</p>

				Administrative Considerations	<p>decision making, and critical thinking, experiential learning opportunity; evaluation of skills and knowledge; experience rare incidences;</p> <p>Disadvantages: feelings of inadequacy by students; lack of fidelity; cost of technology and upgrading; small numbers of students; faculty time and training</p> <p>Testing the effectiveness of this technology; student satisfaction;</p> <p>Use in a variety of courses: med-surg; peds, Maternal-child; critical care;</p> <p>Cost burden for simulator and upgrades, faculty time and training; use</p>
Nehring, W.M. & Lashley, F.R. (2004). Current use and opinions regarding human patient simulators in nursing education: An international survey. <i>Nursing Education Perspectives</i> , 25, 244 – 248.	The purpose of this study is to describe curricular simulation use, faculty time and use, student opinions, evaluation and other uses, research and CE use.	Descriptive research study about simulation use in schools of nursing and simulation center.	34 schools of nursing and 6 simulation centers who obtained a METI human patient simulator™	37 closed and open items, content validity was determined.	<p>The greater than 50% of the schools used simulation less than 5 % of the time during a week, 60% of the simulation centers used simulation &gt; 5% of the time</p> <p>HPS was used in nursing schools for basic nursing skills; physical assessment; medical-surgical nursing; and advanced med/surg.</p> <p>HPS was used for synthesis of knowledge, technical skills, management of critical events; management of complex patients, airway management; communication skills; use of nursing processes; arrhythmia detection. ACLS, Team management; psychosocial skills.</p>

<p>Rhodes, M.L., &amp; Curran, C. (2005). Use of the human patient simulator to teach clinical judgment skills in a baccalaureate nursing program. <i>Computers, Informatics, Nursing</i>, 23, 256-262.</p>	<p>To describe the development of a case scenario to enhance critical thinking by senior nursing students.</p>	<p>Describe the development of a simulation experiences; evaluate faculty experiences and evaluate student experiences.</p>	<p>Faculty involved in the development and students who participated</p>	<p>Faculty report of ??? 13-item student survey of experiences with some open ended questions</p>	<p>Description of the simulation development and parts included: Case Scenario and it's objectives; pre-simulation orientation, simulation, post-simulation debriefing.</p> <p>Faculty evaluation: faculty felt that critical thinking could be applied in the simulation experience, and expressed in the structured debriefing, and the students responses to the survey. They felt the simulation experience met the designed objectives.</p> <p>Student survey results: Positive responses: simulations are positive experiences, beneficial experiences, students noted they were using critical thinking to complete the simulation, felt the scenario was realistic. Negative responses: too many students, felt disorganized, scenario too short, didn't like role-playing.</p> <p>Discussion: increase self-confidence, strengthen a student's ability to make good clinical decisions, Simulations can be "structured specifically to the level of the student's knowledge, which builds confidence" (p. 261). Need team to design and implement simulations, increase faculty education and time to learn simulation, faculty developing the scenario should be an expert in content.</p>
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Smith, S.J.& Roehrs, C.J. (2009). High-fidelity simulation: Factors correlated with nursing student satisfaction and self-confidence. <i>Nursing Education Perspectives</i> , 20, 74 -78.	The study looked at factors that correlated with student satisfaction and self-confidence.	Descriptive, correlational study	Junior level students	Student satisfaction and self-confidence scale Simulation design scale	IT was found that design characteristics, especially clear objectives and an appropriately challenging problem to solve were significantly correlated with satisfaction and self-confidence. Implications: that faculty need to pay attention to the design of simulations and make sure that all factors are carefully addressed.
Thompson, T. & Bonnel, W. (2008). Integration of High-fidelity patient simulation in an undergraduate pharmacology course. <i>Journal of Nursing Education</i> , 47, 518- 521,	To describe the use of simulation in a non-clinical pharmacology course.	Describe purposes of simulation, theoretical framework and process, describe pharmacology simulation and evaluation of the implemented simulation.	72 student participants	Descriptive report, formal testing, skill testing, and reflective writing.	<p>Purposes of simulation: “to teach and reinforce theoretical and clinical knowledge; to ascertain the level of performance of certain clinical skills and interventions; to practice critical thinking for the purposes of clinical reasoning; to explore alternative clinical decisions in a safe environment; to answer research questions” (p. 519).</p> <p>Scenario outcomes: students varied in their use of clinical decision making abilities, skill level abilities, and use of available resources. There was a disconnect between previously tested dyadic material and application of that material. Lack of basic safety parameters enforced for patients regarding medication administration. Students reported high levels of anxiety during the scenario when things bad, and relief when things worked, and that the simulation was valuable to practice in a safe environment.</p>

### Appendix 3a Email to Consent Nursing Programs

Dear Dean/Director/Chair,

Greetings, my name is Teri Thompson. I am currently a doctoral candidate at the University of Kansas School of Nursing. I would like your College/School/Department to participate in my dissertation study entitled “Meaningful use of simulation as an educational method in Nursing Programs”. The purpose of the study is to investigate the use of simulation technology in Nursing Programs with regard to educational practices.

Initially, I am contacting the Deans, Directors, or Chairs of specific programs leading to registered nursing degrees so that you can identify the person within your school that is most familiar with simulation use. If your College/School/Department agrees to participate in this research, please forward the attached letter to the identified Simulation Expert. Your Simulation Expert would be the person who has the most knowledge or experience about simulation use within your College/School/Department.

Within the attached letter is a secure link for an electronic survey. Consent is implied by filling out the survey. The approximate length of time that the questionnaire will require is approximately 45 to 60 minutes. Your name and the school of nursing you are associated with will not be used as identification on the survey. If you would like results from the research study please feel free to email me at : [tthompson@kumc.edu](mailto:tthompson@kumc.edu) or [teri.l.thompson@gmail.com](mailto:teri.l.thompson@gmail.com).

I would like to thank you in advance for helping me complete this important research. It will be able to inform not only new Colleges/Schools/Departments who are just starting their programs of simulation, but will help those currently using simulation through the sharing of knowledge.

With sincere thanks,

Teri L. Thompson, PhD(c), RN, CPNP

## Appendix 3b Email to Consent Participants

Dear potential study participant,

Greetings, my name is Teri Thompson. I am currently a doctoral candidate at the University of Kansas School of Nursing. I would like you to participate in my dissertation study entitled “.Meaningful use of simulation as an educational method in Nursing Programs”. The purpose of the study is to investigate the use of simulation technology in Nursing Programs with regard to educational practices.

Your Deans/ Chair/ or Directors has identified that you are the person within your school that is most familiar with simulation use. This study will help nurse educators understand different ways to use simulation across the nursing curriculum and help us begin to establish what the best practices of simulation are for nursing education.

The approximate length of time that the questionnaire will require is approximately 45 to 60 minutes. Your name and the school of nursing you are associated with will not be used as identification on the survey. There will be no way to identify your participation in this study. All electronic data will be stored securely on a University of Kansas server for 10 years and then destroyed. All shared information will be reported as group statistics, so identification will not be possible. You will be contacted every two weeks until the study ends. As there are no identifiers letting me know if you have participated or not, I would ask that you please disregard these emails if you have participated.

There are no foreseeable risks of participating in this survey. The time to complete the survey and the evaluation of the survey may cause you inconvenience. Confidentiality of your information will be protected as much as possible. Your name will not be used on any documents. The information that you report will not be reported individually.

There are no direct benefits to participating in this study. The study information may benefit those who are attempting to establish simulation labs/teaching methods at their educational institution.

There is no cost to you to participate in this study nor is there any payment. The alternative to participating in this study is not to participate. Participation is completely voluntary. The investigators will keep secret all research related records and information from the study.

The investigator will answer any questions you have until you are fully satisfied with the explanation of the study. If you have any more questions you may contact Teri L. Thompson, RN, MSN at (816) 213-9888 or her faculty mentor Karen Wambach, RN, PhD at (913)-588-1639. If you have any questions about your rights as a research study participant, you may call (913) 588-1240 or write Human Research Subjects Committee, University of Kansas Medical Center, 5012 Westcoe, 3901 Rainbow Blvd, Kansas City, Kansas 66160-7700.

If you agree to take part in this study as a research participant you may quit at any time or refuse to answer any questions that are uncomfortable for you. In the event that you decide to quit, the information you have already provided will be kept confidential and not used in the study. By completing the survey you are giving consent to participate in the study. The survey can be accessed through this secure link:

<https://survey.kumc.edu/se.ashx?s=5A1E27D277CCA946> .

Thank you for considering participation in this study, so that this timely research can be completed.

Sincerely,

Teri L. Thompson, RN, MSN, Doctoral Student, University of Kansas School of Nursing

Karen Wambach, RN, PhD, Faculty Mentor



## Appendix 4

Table A2: Respondent Report of Process to Develop Simulation and Learning Lab

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**Table A2: Process to Develop Simulation and Learning Lab**

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We had a volunteer group of faculty who visited several schools with simulation space as well as conferences. They designed the space. Space was funded by university money.

2 faculty members very involved in the lab visited a variety of simulation centers and developed plans.

The director of the nursing program had the main input into the design and development of the sim lab. With input from all full time faculty for various needs and ideas. The space was funded with allocated monies from the state legislature and a grant written by the director of the program.

We consulted with Laerdal about how to build a simulation lab after meeting with the nursing faculty to find out what they wanted in a nursing lab. The plans from Laerdal were then given to an architect to help design the lab space. After several drafts and meetings on the design, a layout was decided. The Chair of the Nursing Department along with the Vice President of Finance held the main responsibilities for the construction of the lab space. The lab space was funded by a generous donor that combined our previous lab space and a joining classroom to make one large lab space

The Chair of the Nursing Department consulted with Nursing Faculty as to their wants and needs. The list was presented to Laerdal and Nursing worked with them to develop a plan for the simulation area and lab space. After several drafts were done an architect was brought in to draw the final plans. The donor was generous as the construction was taking place and if we needed additional dollars then it was donated.

We contacted Laerdal and Create-A-Lab did a design with the wants and needs of the Nursing Faculty after they were consulted. Then some modifications were made to the layout and then plans were drawn up and construction began.

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## Appendix 5

Table 3A: Respondent Report of Description of Simulation Laboratory Space

Table 3A : Description of Simulation Laboratory Space
10, 500 square feet encompassing 6 simulation labs, 3 control rooms and 2 exam rooms.
We recently moved locations and have eight patient rooms and one nursing station to support our simulation Lab.
We have constructed a simulation viewing room and converted two other offices to simulation lab rooms contained within the nursing skills lab.
We are in a 'new' space, opened in 2007. We have an 9 bed lab, and a simulation hospital room. The space we have is nice, but there's little room for storage and no room for expansion.
We have two learning labs. The lab with the simulators is on the main floor. One room is completely oriented to high fidelity simulations with a control room and video capabilities.
Large room, equipped with 7 mock-hospital rooms that have a working wall mount, and low fidelity manikin, and portable cameras in each room.
- Skills lab with 6 hospital beds, 1 cart, an infant crib, storage and tables for discuss.
Main simulation room. Houses SimMan3G (but can be rearranged for a variety of simulation), patient vitals monitor, crash cart, working wall-mount with suction and simulation oxygen, 2 mounted cameras routed in through the Meti-learning Space, and two-way mirror that is connected to a viewing room.
A Flexible Peds/OB room that houses SimBaby, and patient monitor.
(In-Development) A mobile Safe-Practice room, contains shower and bathrooms, as well as lift equipment and other safety practices.
Yes, we use our nursing lab. We have 4 manikins with 4 hospital beds. We do have supply cabinets.
We have a room within our lab specifically for our human patient simulator. The meti-man is in the general lab.
Four bed simulation lab on first floor of building with functional gas/air/suctioning head walls. Hi Def AV equipment with adjacent classroom space for viewing video

## Appendix 6 IRB Approval

### The University of Kansas Medical Center

#### Human Research Protection Program

October 22, 2010

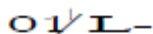
**Project Number:** 12375  
**Project Title:** Meaningful use of simulation as an educational methodology in Schools of Nursing  
**Sponsor:** None  
**Protocol Number:** N/A  
**Primary Investigator:** Karen Wambach, Ph.D.  
**Department:** School of Nursing  
**Meeting Date:** 09/14/2010  
**HSC Approval Date:** 10/20/2010  
**Type of Approval:** Exempt b (2)

Dear Investigator:

This is to certify that your research proposal involving human subject participants has been reviewed and **approved** by the KUMC Human Subjects Committee (HSC). This "exempt" approval is based upon the assurance that you will notify the HSC prior to implementing any revisions to the project. The HSC must determine whether or not the revisions impact the risks to human subjects, thus affecting the project's "exempt" status. Projects that do not meet the "exempt" criteria must comply with all federal regulations regarding research.

If you have any questions regarding the human subject protection process, please do not hesitate to contact our office.

Very truly yours,



Daniel J. Voss, M.S., J.D.  
IRB Administrator